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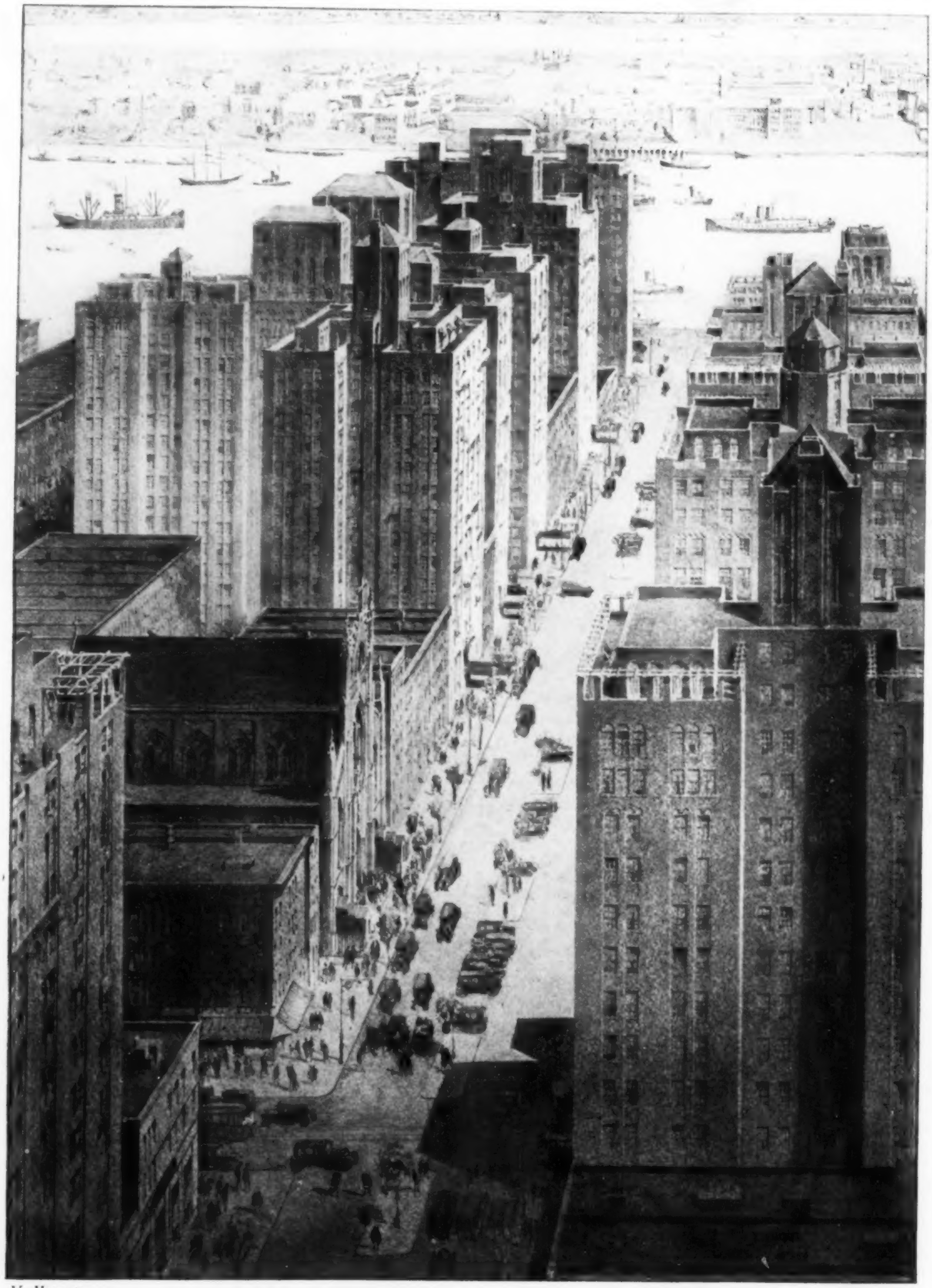

V. Hagopian

VISUALIZATION OF AN APARTMENT DEVELOPMENT
EAST 79TH STREET, NEW YORK

THE ARCHITECTURAL RECORD

AN ILLUSTRATED MONTHLY MAGAZINE OF ARCHITECTURE & THE ALLIED ARTS & CRAFTS

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THE MODERN APARTMENT HOUSE

BY HENRY WRIGHT

Whether the interest in apartment living represents a psychological change of mind or whether it has taken place because the concentration of population in our cities has necessitated an abode that is easily accessible, is a debatable question. Public interest in the subject, however, can be readily gauged by the increasing volume of apartment building.

Last year more than a quarter of a million new apartments were erected in the United States. This, in terms of floor area, represents an increase of 245,000,000 square feet of living space. But was this increase in available living space used to best advantage?

Based upon examination of a large number of plans by architects, and assuming that architects' plans average at least as high in planning efficiency as the eighty per cent of buildings produced without the benefit of architects' counsel, it is safe to estimate that at least 40,000,000 square feet of this space was devoted to halls and corridors. At least half of this might have been saved; saved not only in regard to actual cost but to provide larger room-sizes and light courts—features so hopelessly inadequate in many apartment buildings. The architect of a Midwestern apartment building, after using a large part of the first floor in a complicated labyrinth of lobbies, continued on the upper floors with a series of halls, stair halls, corridors and foyers; then, having exhausted the vocabulary of terms, assigned the remaining interior wastes to dressing closets and dining nooks!

I. EVOLUTION

Scarcely a generation ago the apartment house was characterized as an "undesirable and makeshift habitation" suitable only for individuals with transient habits. Today we find those who select their place of residence with deliberateness and with an eye to comfort and convenience, turning to the apartment house as a matter of choice.

To understand the evolution of the apartment one must recognize that it first came into being as an offshoot of the hotel; its function was to accommodate the semi-transient and well-to-do, who, for one reason or another, did not care to assume the responsibilities of a house. But the new

trend, exemplified by those apartments which are invading our suburbs, comes from the other extreme. Here we have a number of home units, combined or grouped together for convenience of service, differing widely in character from the *hotel* yet not far removed from the *house*.

In these modern apartment-groups the problem requires a limited number of suites off each entry stair, the latter being a mere vertical extension of the public street. Centralized control and porters are eliminated. The dumb-waiter is still used for delivery of provisions and disposal of refuse, but even these services are being partly supplanted by mechanical refrigeration and incineration. Such grouping departs from the house standard only in the common care of heat and of landscaped open areas—a factor since the automobile has supplanted the lawn mower as a popular recreation. Thus the whole problem has shifted, enlarging both the scope and the manner of solution, extending not only into the field of comprehensive planning but giving rise to new forms of tenantry and coöperative ownership.

There is a very definite distinguishing quality of domesticity or homelikeness in arriving at one's apartment door directly, by way of stair or elevator, instead of having to wander along a winding corridor to reach the entrance. On the one hand we have a mere street-extension which leads to the very entrance door, while the other method harks back to the *hotel*. Among apartments constructed during the past year, whether low or tall buildings, there is a marked tendency *to substitute more stairs or elevators per building* with a consequent reduction in lateral entrance halls. This change is more evident in the East than in the West. Facts to determine whether increasing the number of elevators balances former hall waste in the matter of cost, are not at present available. Probably in New York the reduced net ground coverage of the new trend can be justified by a reduc-

GENERAL VIEW

TYPICAL FLOOR PLAN

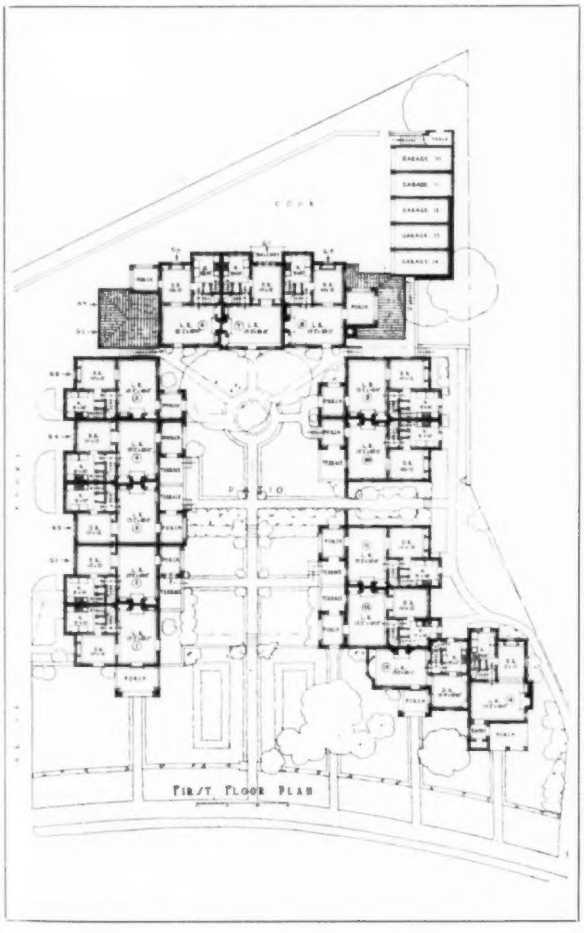
FIG. 1. STEPDAUGHTER OF THE HOTEL

A reinforced concrete apartment building in which everything is furnished even to linen and china

WHITEHALL APARTMENT BUILDING, CHICAGO

KLABER & GRUNSFELD, ARCHITECTS

VIEW OF COURT



PLOT PLAN
FIG. 2. STEPSISTER OF INDIVIDUAL HOUSE, grouped for central heating convenience.
PARK AVENUE COMMUNITY GROUP, BRONXVILLE, N. Y.
PENROSE V. STOUT, ARCHITECT

tion in ground rental ample enough to pay for increased service charges.

At any rate, the factor of improved privacy and domesticity is having its share of influence. It is particularly interesting to note the application of this principle to examples of towering apartment buildings limited to one family to the floor. These apartments, often palatial in size, are, aside from unsatisfactory sound proofing, practically equivalent in privacy to any form of single dwelling in city surroundings. In contrast to these towers is an interesting group from Bronxville where dwellings with apartment house advantages are ranged horizontally rather than vertically—a series of cubicles so inter-related as to assure privacy and outlook. Each apartment has its own garden, but entrance courtyards and garage features are shared. (Fig. 2).

A survey of apartments of the more expensive grades shows increasing evidence of the entire omission of the dining room as a necessary element of the plan. This is not a matter of a "kitchenette" or dining alcove arrangement, but the provision of a complete kitchen and large living room which becomes the *living room* in fact as well as in name. The apartment with terrace balcony and even garden is increasingly popular and the tall apartment, like its commercial predecessor, is beginning to flower architecturally in its upper reaches.

In the apartment the public has been willing to accept certain limitations in regard to space and services, which are not even yet recognized as admissible in house design. These variances in apartment house and home psychology are to be noted in the more formal requirements of front and rear entrance (frequently lacking in the apartment), in the elimination of the dining room as a separate entity, in the abandonment of the home laundry and other features of a similar character which were first eliminated of necessity under apartment house restrictions but are more reluctantly abandoned in the private dwelling. In certain

parts of the middle and far west, space saving has been carried to an extreme in what has been known as the "efficiency" apartment. This has indeed served a purpose and may continue to do so in the case of the fragmentary family or the retired couple. But there is a growing insistence for apartment house comfort, ease of living and economy by a large class of younger families, which emphasizes the need for "real" bedrooms and proper provision for child life.

In view of these considerations which seem definitely to require the enlargement of the architect's field of service, we have chosen in this annual number to feature those forms of apartment house design which tend to stress a *domestic character*, particularly the few-storied types of semi-urban construction. In doing this we have in mind a threefold purpose: (1) to direct attention of the architect to the peculiar problems and opportunities in the apartment house field; (2) to show the public how poorly and indifferently it is being served by the extensive building of ugly and inefficient speculative apartments; and (3) to make use of a limited but very valuable and dependable source of data and material for comparative study that exists for the investigation of so-called model tenements. These exemplify some of the methods of better planning made possible through the widely spreading demand for home-type apartments.

In pursuing our third purpose it may seem that we have chosen the work of a few architects to the exclusion of others who might be credited with similar important accomplishment. This we admit, but our purpose is to present the elements of the problem through the most available and valued sources of detailed information, and through the use of building types sufficiently uniform in plan and construction to permit practical comparison.

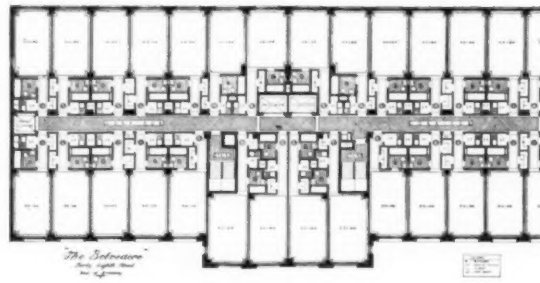


FIG. 3

APARTMENT HOTEL WITH SINGLE ROOMS ACCESSIBLE FROM CORRIDOR

THE BELVEDERE, 48TH STREET, NEW YORK

LAURENCE AND JOHN SCACCHETTI, ARCHITECTS

FIG. 4

APARTMENT HOUSE AT 151 EAST 83RD STREET, NEW YORK

SCHWARTZ & GROSS, ARCHITECTS

FIG. 5

APARTMENT HOUSE AT 140 EAST 81ST STREET, NEW YORK

J. M. FELSON, ARCHITECT

II. BASIC REQUIREMENTS FOR APARTMENT PLANS

In all efficient planning of apartment house units of the domestic type, the objective of the designer is to place together in a compact and convenient manner the largest amount of space comprising the simple two-room-deep cross section. In the "efficiency" apartment and the apartment hotel the tendency persists to group a large number of suites reached from a continuous hall and also to elongate the space from wall to wall by internal position of closets and baths as in fig. 3. The domestic apartment, on the other hand, finds its maximum efficiency in the *grouping of a few apartments to the floor* from each stairway (or elevator) so as to eliminate all public hallway except the stair. Where high cost land is not a factor, further efficiency is usually found in limiting the "span" or building width from wall to wall to the depth of two rooms, without interior halls except a minimum hall giving access from bedrooms to bath. On the other hand, the almost universal planning of buildings in relation to a valuable street frontage and limited lot width has tended to develop plans in all classes of apartments in which rooms take a decidedly elongated, rather than square, shape.*

There are also certain human factors which determine the minimum room shape and size. Bed length decrees that a bedroom should have a minimum width of 9′ 6″, some designers would say 10 ft., to accommodate bed length, passage and furniture on the opposite wall. Sink, range, and similar items more or less common to every apartment, set a minimum size for the kitchen. The kitchen, at least, has been brought to a high measure of efficiency by accomplished planners.

We may set up the following as the average problem in the field of specialized apartment planning which we are about to study: a standard cross section for two-room-deep efficiency, a grouping of a few apartments per floor to each stairway, and a medium size of accommodation ranging from three to six rooms and one bath. These limitations are placed only for the purpose of realizing a uniformity for study and comparison, involving such matters as plan and cost efficiency, especially in the site planning field. The principal elements involved in this first study, primarily of plan efficiency, are:

1. The size and character of the rooms.
2. The number of rooms per apartment.
3. The number of apartments to a stairway.
4. The losses required for ground floor entrance.
5. The spacing of stairways.
6. The disposition of occupied two-room-deep building area in relation to open area.

The question of building height must be omitted for the present as it introduces such complicating factors as sunlight and elevators. These present studies apply to buildings of three, four and five stories (six in some New York examples) which are normally recognized as non-elevator heights in many cities.

III. BASIC PLAN TYPES OF SIMPLE TWO-ROOM-DEEP UNITS

An examination of a large number of such plans for sites larger than the single city lot seems to suggest a grouping into a few basic types. Here we omit from consideration the single T or L-shaped apartment building on a narrow lot with hall access from a single entrance.

The most common form is based upon the "H" which is, of course, a pair of T's. The H plan was first developed with the legs parallel to the street, a form which we here term the "Lateral H" plan (fig. 6a). It is interesting to trace the manner in which

*The examination of a number of suburban apartments indicates the tendency to revert to rooms that approach a square where frontage value is a less important factor. (See plan of the Kelvin Apartment at Forest Hills, L. I., page 255.)

this popular plan evolved from the old 25 ft. lot "Dumb-bell" plan of New York through the present 50 ft. lot with 70 per cent site coverage, and finally to larger and wider site requirements (fig. 8, a, b, c).

The H plan is, however, frequently extended and used in another direction, perpendicular to the street. This has been termed the "Perpendicular H" (fig. 6b), frequently used in large projects. It may be noted that both forms of the H plan sacrifice a considerable amount of ground floor in order to give access to stairways and to relate them all to a street entrance (fig. 9). An exception is to be noted in the use of the plan in the manner shown in the 158th Street Thomas Apartments (page 222).

Two types of "U" plan, the "U Court" (fig. 6c), and the "Closed End U" (fig. 6d), may now be considered. The "U Court" is employed extensively for large apartments in semi-suburban districts where an extra deep frontage adjoins a business area (page 221, fig. 10). The "Closed End U" has been effectively used by the architect Andrew J. Thomas in Jackson Heights, L. I., and in his apartment group for the Metropolitan Insurance Company in Long Island City. In the last, by grouping the U plan on opposite street frontages, the open garden court, augmented by the required rear yard space, effectively combines two courts into one. The "U Court" can usually be arranged without much loss on the entrance floor. Its chief defect is due to the fact that designers tend to crowd buildings of this type too close in their side and rear exposures, whether in relation to the individual lot lines or in the grouping of a large number of buildings, as in the Metropolitan example (page 221, fig. 11).

There remains for our consideration the continuous "straight element" apartment in the form of a continuous "Perimeter" plan. This involves merely a different disposal of the same elements that compose the large "U Court" but employs a larger proportion of straight units (fig. 7c).

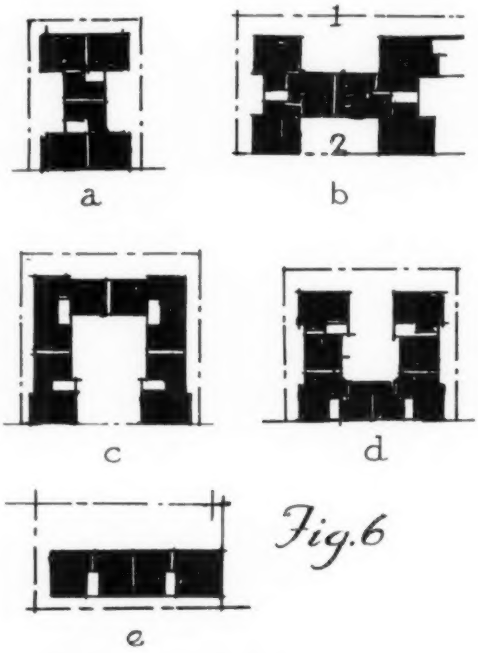


Fig. 6

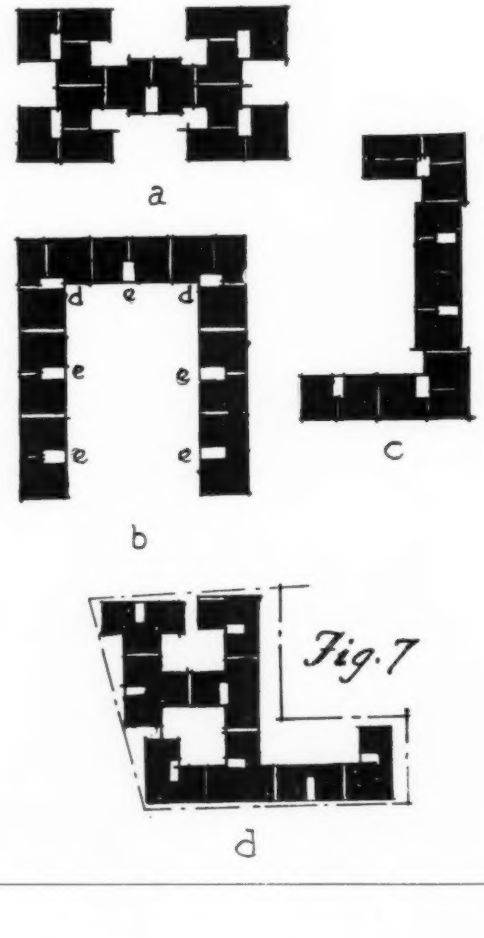


Fig. 7

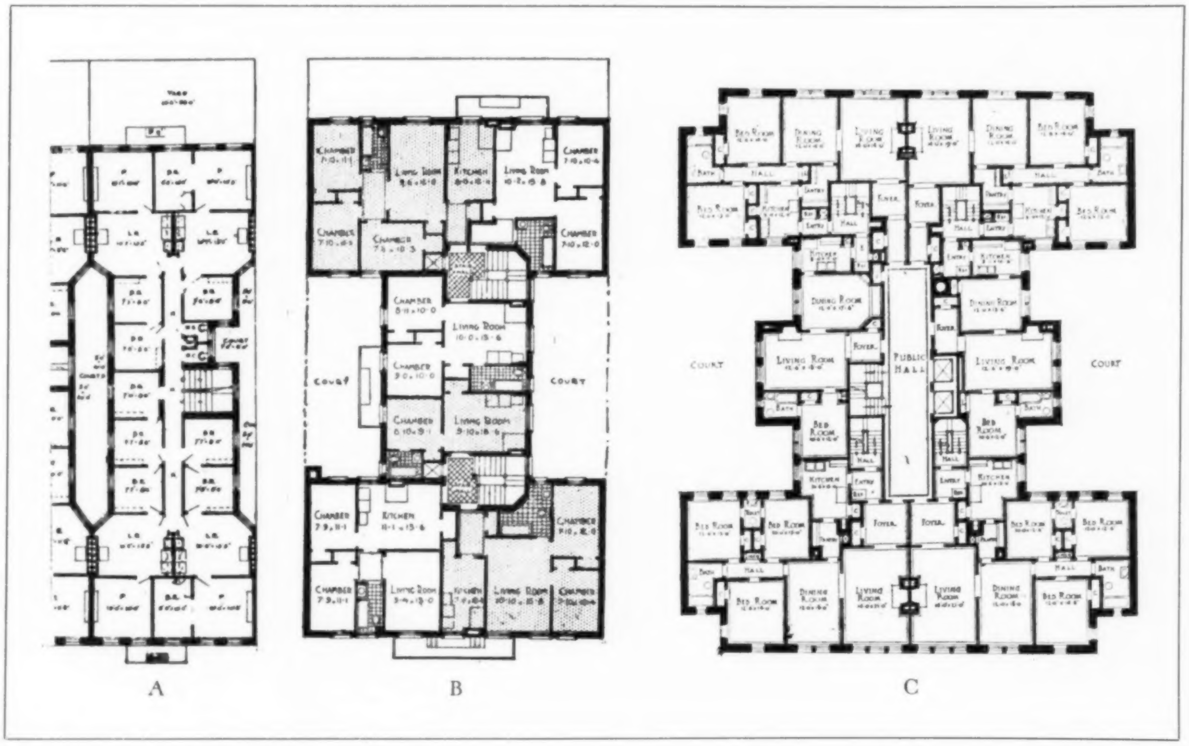


Fig. 8. EVOLUTION OF "LATERAL" TYPE "H" PLAN.

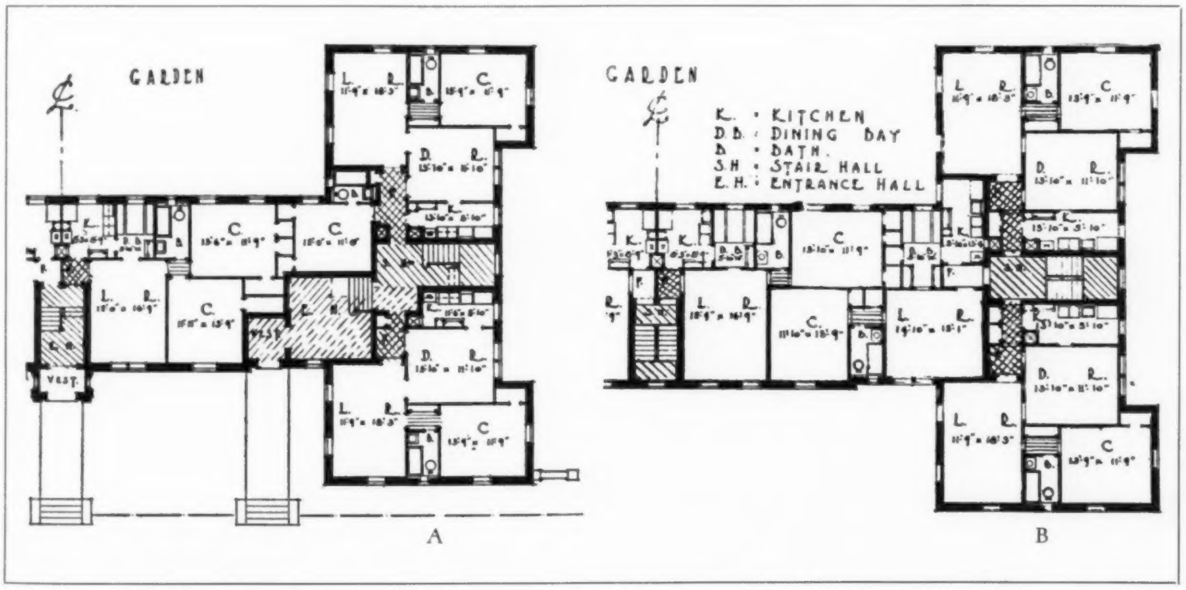
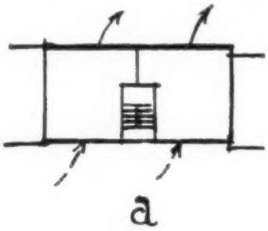


Fig. 9. EXAMPLE OF "PERPENDICULAR" "H" TYPE APARTMENT, SHOWING HOW THE EFFICIENCY OF TYPICAL FLOOR (A) IS REDUCED BY LOSSES IN ENTRANCE FLOOR (B).

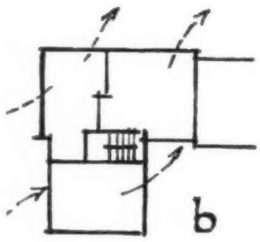
Basic Plan Elements

These typical plans may be broken down into their simple units or elements as follows:

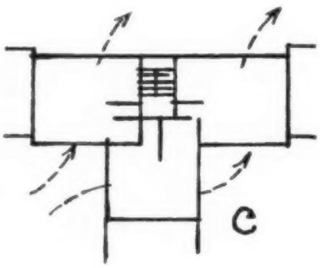
(a) *The straight or "link" element.* This is used in all forms of plans where the project is sufficiently large and free from complications to require an extension of any form of "Perimeter" planning.



(b) *The corner of "angle" element.* This is a feature of all larger plans which constitute a simple perimeter, such as the large U court or the complete perimeter types.

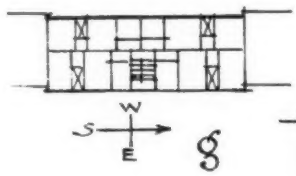


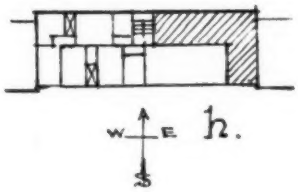
(c) *The T element* is involved in all H plans and may be used singly or as a terminal element. All these units deserve study in detail.



The "link" element is best adapted to two apartments from each stair, otherwise it is difficult to obtain proper sunshine and cross draft.

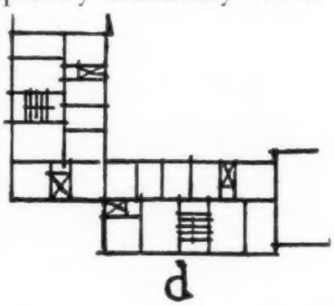
For interior locations and where the construction requires party wall units, either a four or six-room apartment is most efficient. Interlocking apartments, it should be noted, may have an odd number of rooms. For an end position, a five-room arrangement is very common, placing the bath on the end wall between bedrooms. In New York a cross draft is not so necessary as in the Midwest, so that four apartments usually with two or three rooms each, may be effectively grouped around a stair, each apartment having one exposure only Such apartments should be placed only in buildings running north and south, otherwise two of them would be restricted



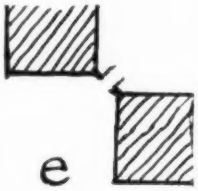


to northern exposures. A variation is possible for an east and west element by bringing the north apartments around the end of the south apartments, securing sunshine and cross draft for the north apartment and cross draft for the south apartment through the public stair hall (h).

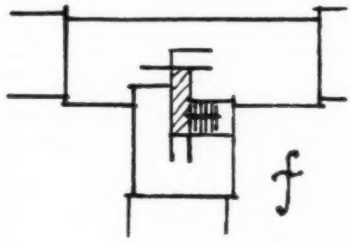
The "corner" element is subject to a wide variation of treatment. It is most suitable for three apartments to a stairway in which the corner suite is usually smaller in number of rooms and receives a diagonal cross draft and two exposures, one of which necessarily has sunshine The "corner" element,. however, is always subject to some plan waste, and is frequently extremely wasteful. Its most effective variant is the "partial lap" corner (d) in which a space one-half the width of the normal "span" depth is not

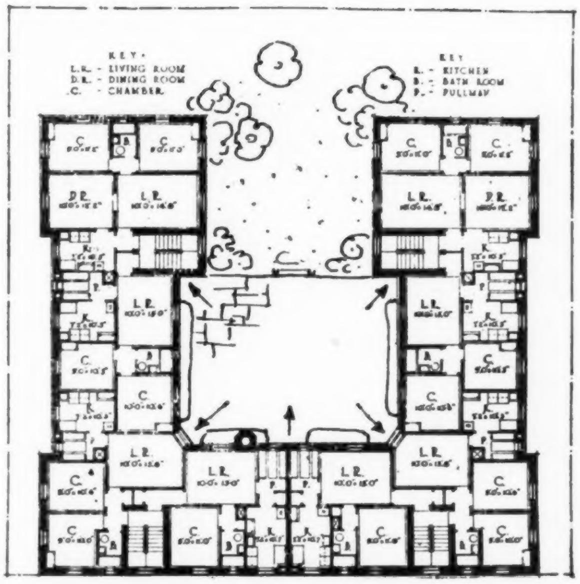


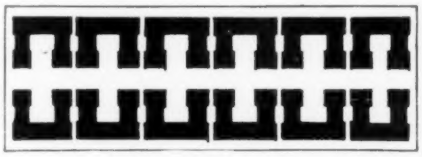
built upon (see plan of Wilson Court, page 246). In many foreign examples, particularly German ones, the corner is omitted altogether (e). This naturally results in a maximum plan efficiency and uniformity but there is a loss in land coverage which we, in America, are not yet ready to accept.



The T element is most effective where it is possible to put the stairway in the cross-bar as in (c), without ground floor loss. This we may term the "Stair in the Head T," and it forms the basis of the very interesting "Thomas Apartments" (fig. 9, page 219). The T is almost invariably more wasteful where the stair must be placed in one of the interior angles (f). This may be further studied in the case of the Michigan Boulevard Gardens' project, Chicago (page 224), a very efficient plan in both its straight and corner elements but less efficient in its two T elements. Here it was necessary to place the stair in the angle because of more important requirements of the first floor store arrangement.







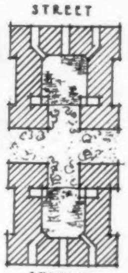


FIG. 11. EXAMPLE OF THE CLOSED "U" PLAN, METROPOLITAN APARTMENTS, LONG ISLAND CITY
ANDREW J. THOMAS, ARCHITECT

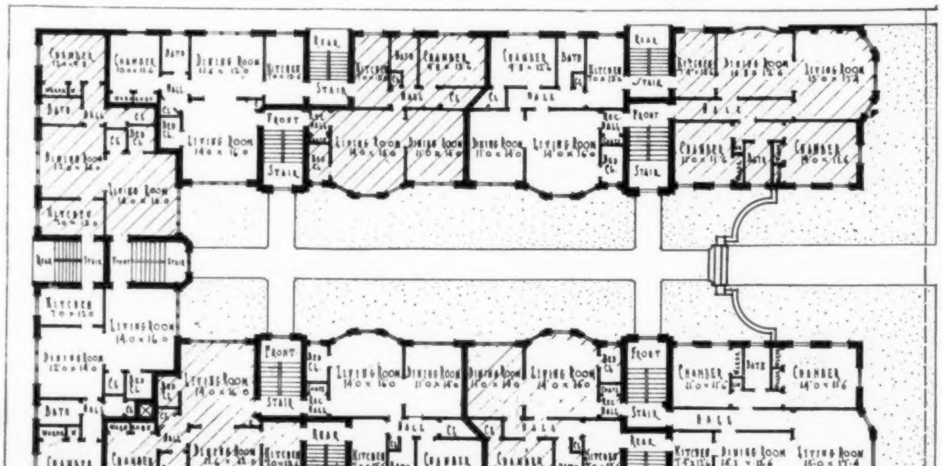


FIG. 10. EXAMPLE OF "U COURT," STONELEIGH COURT APARTMENTS, EVANSTON, ILLINOIS

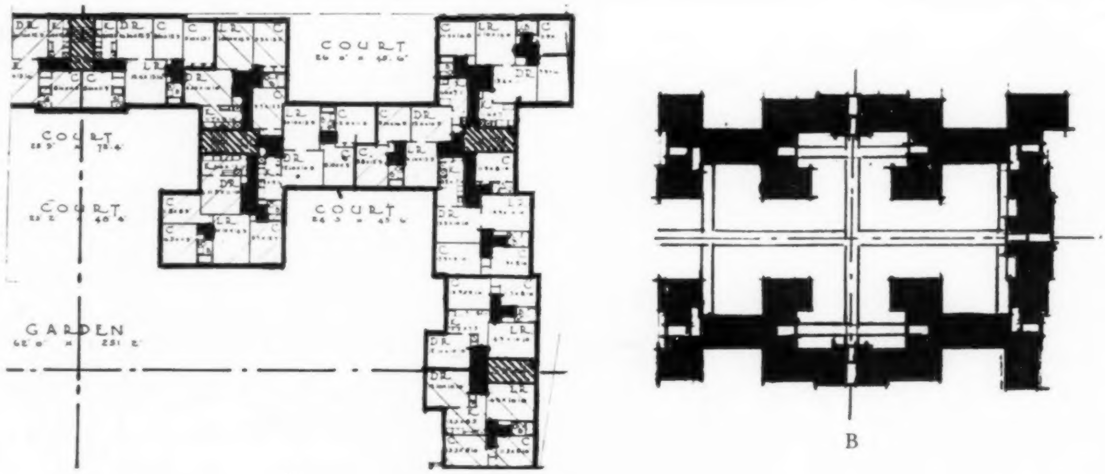
IV. LARGE PROJECTS ILLUSTRATING BASIC PLANS

Now we are ready to study the relative efficiency of large scale projects involving the use of the simple, efficient, two-room-deep principle. Perhaps the best example of the developed H plan is to be seen in the 158th Street apartment building in the Bronx, N. Y., by the architect Andrew J. Thomas. This is a series of four large H's, of the "Stair in the Head" variety, composed of two T's with one stair and three apartments; having five and six rooms in each T and three "link" elements joining the H units with two apartments of five and six rooms each. It will be seen that the "Stair in the Head" plan is suitable for three equal size apartments with two exposures and cross draft in every case. This group has a larger amount of interior hall space than is usual in Mr. Thomas' plans, due to the provision of a separate lodger's room and bath in many apartments and the joining of every bedroom to the bath by means of a bath hall. There is an ingenious arrangement of entrance walks in the central courts on each side so that the stairs in the T head element may be reached without ground floor loss. This plan proved so successful that it was used again in the proposed group for Danbury (illustrated in The Architectural Record, March, 1928).

Many examples of large U courts could be cited. They are made up frequently of two corner elements, three link elements and two end link or modified T elements at the entrance front, as shown below.

The large simple perimeter plan, composed of the same elements as the U court, has been employed extensively for many years in large scale developments abroad. Particularly is this the case in many recently-built apartments in Holland and Germany.

In America, the plans of Mr. Clarence Stein at Sunnyside, L. I., serve as good examples of this simple treatment. In The Architectural Record for March, 1928, Hamilton Court was reproduced and Monroe Court at Sunnyside is illustrated on page 227 of this issue and shown diagrammatically on page 223. This is a continuous "Single Perimeter" plan which although it contains a large court 130'x 130', has a



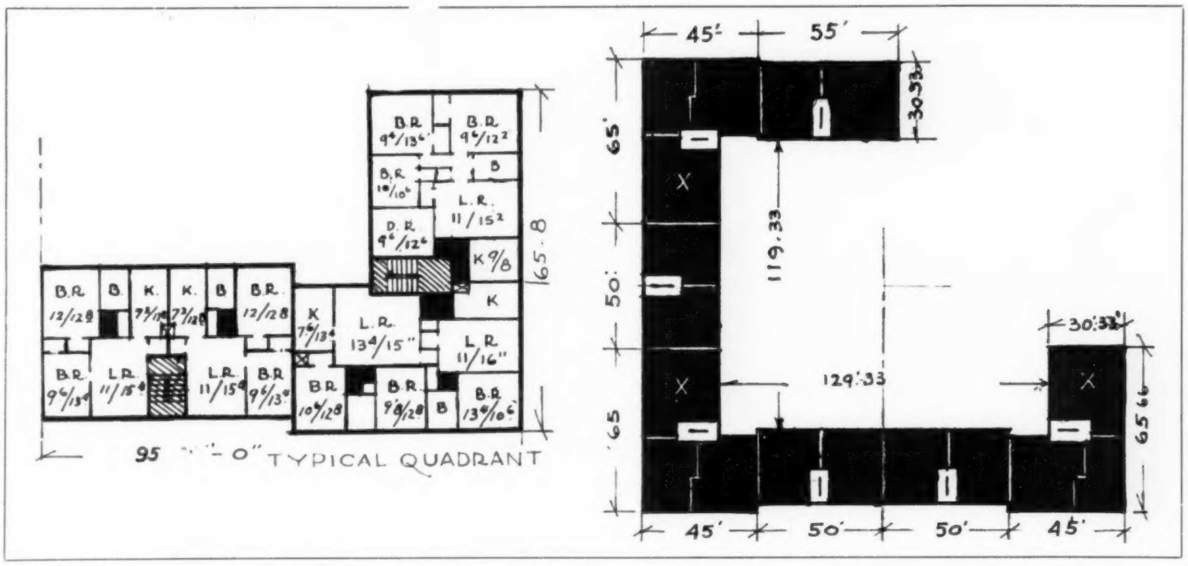
A B

EXAMPLE OF "H" TYPE PLANNING WITH EFFICIENT ENTRANCE ARRANGEMENT

A. TYPICAL CORNER B. COMPLETE BLOCK PLAN

THOMAS APARTMENTS, 158TH STREET, NEW YORK

ANDREW J. THOMAS, ARCHITECT



EXAMPLE OF SIMPLE PERIMETER TYPE OF PLANNING

NOTE: Sections X, X, X have been altered from plan as actually built. See text.

MONROE COURT, SUNNYSIDE, LONG ISLAND, N. Y.

CLARENCE S. STEIN, ARCHITECT

EXAMPLE OF SIMPLE PERIMETER PLANNING

SKETCH OF INTERIOR COURT OF MICHIGAN BOULEVARD GARDENS, CHICAGO

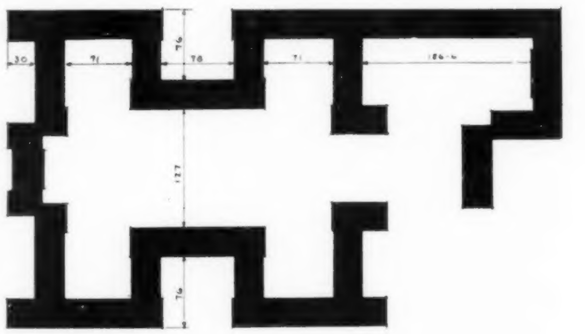
KLABER & GRUNSFELD, ARCHITECTS

very efficient land coverage (see comparative analysis, page 234. In order to make a fair comparison we have altered the actual plan in these diagrams (page 223). The unit X, actually two 3-room apartments, has been converted to one 6-room apartment with rooms of equal or larger area than used elsewhere in the building, but requires 6 feet less length of structure or 180 square feet less gross area per unit. Even this brings the average size apartment for the whole building to only 4.23 rooms.

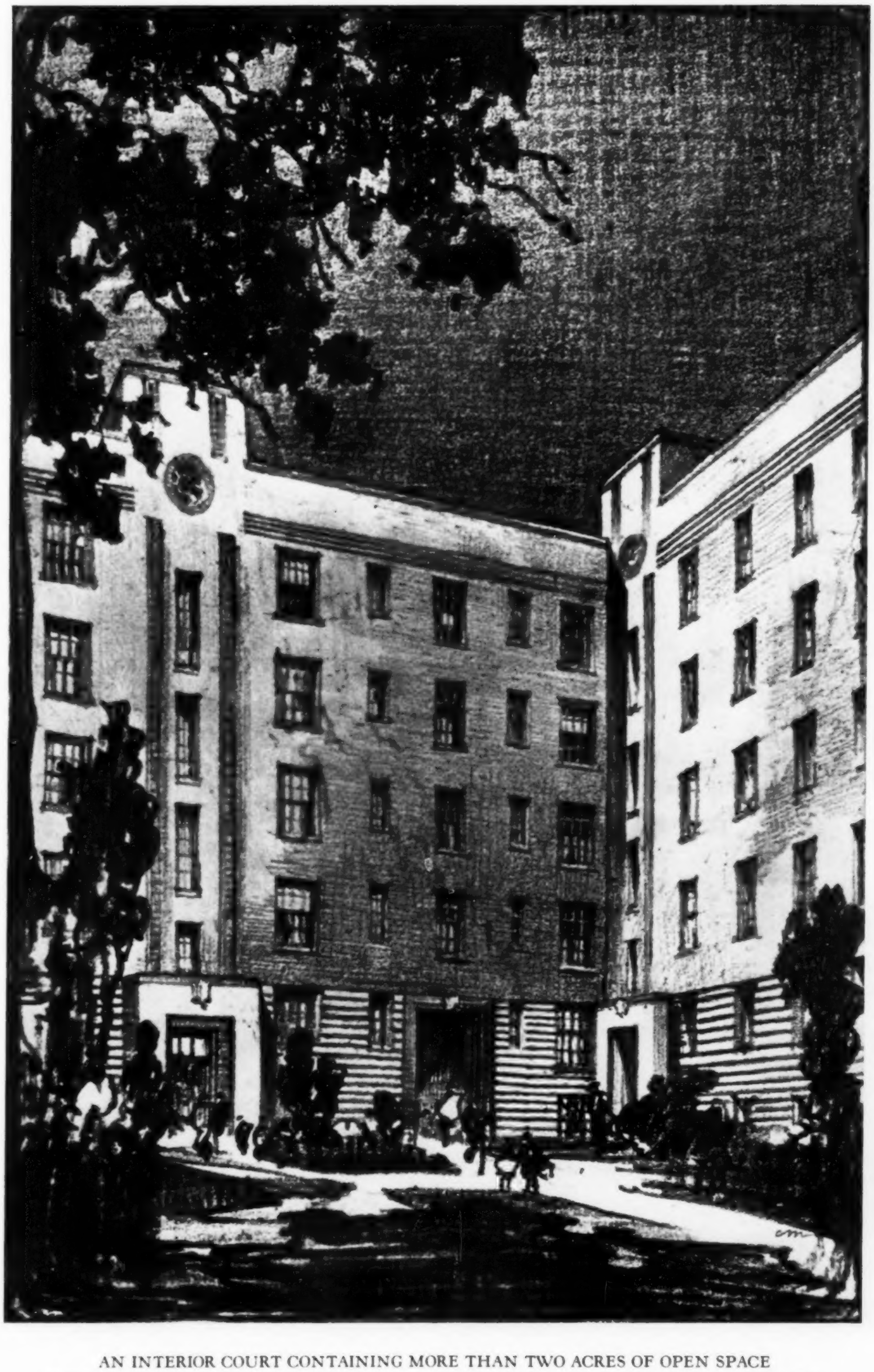
The Michigan Boulevard Gardens' project in Chicago (page 224) may be considered as a simple, indented perimeter type. The reëntrant courts are composed of four "angle" elements only. These are in turn linked together by a single link element. The irregular site and special store conditions at one end render the project difficult for comparison as a whole, but the typical section here shown, repeated four times, constitutes 40 per cent of the project and shows a remarkable degree of efficiency. It also indicates the fact that well studied "angle" elements are equally effective as link elements. The typical floor is 80.5 per cent efficient. The rating is 79.5 with foyers excluded. With a loss of three rooms in thirty-five for the ground floor the efficiency for five floors is 79.15 per cent. These apartments have the advantage of fire-proof construction which results in reduced stair and partition walls. On the other hand, practically all bedrooms are served from a bath hall. (See also comparison of typical 4-room units in Research section).

For a further investigation of relative plan efficiency the reader is referred to the interesting German studies of typical plans for different room sizes (Research section) and the study of relative costs when room size is increased, adding *space* only without increased complexity or equipment (also in Research section).

Plans of apartments produced by builders usually occupy the legal site limit, which in New York is 70 per cent for interior



A SIMPLE INDENTED PERIMETER PLAN
MICHIGAN BOULEVARD GARDENS, CHICAGO



AN INTERIOR COURT CONTAINING MORE THAN TWO ACRES OF OPEN SPACE
INTERIOR COURT, MICHIGAN BOULEVARD GARDENS, CHICAGO
KLABER AND GRUNSFELD, ARCHITECTS

lots and up to 90 per cent for corner lots. In attaining this coverage very large losses in efficiency are usually entailed, especially in regard to elevator buildings. Another characteristic of these "builders' apartments" (fig. 12) is a lavish use of features that serve for "show," such as expanses of tile flooring, gas fireplaces and arched nooks.

Attention is particularly called to fig. 13 where a possible two-family-per-floor flat based upon the Sunnyside 4-room unit is contrasted with a corresponding size flat of the type which is being built more and more extensively in the suburbs of our smaller cities. Not only are these latter buildings grossly wasteful, but they constitute a most unfortunate arrangement of space for convenient housekeeping and necessitate a dreary outlook for 50 per cent of the rooms.

FIG. 12. "BUILDERS' APARTMENT." Example of 70 per cent coverage with wasteful corridor and foyers.

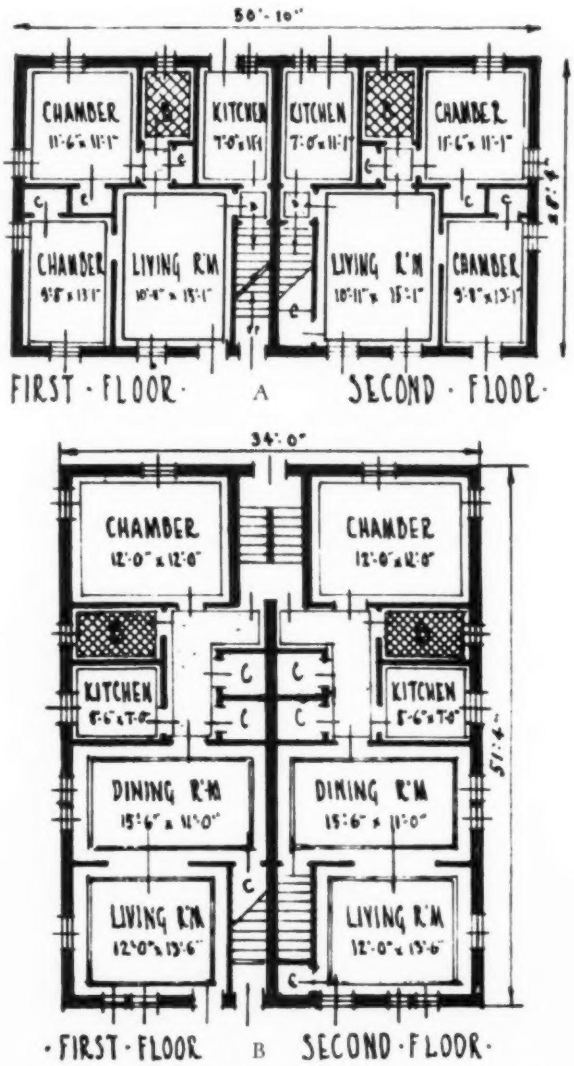


FIG. 13. SUNNYSIDE 4-FLAT (A) contrasted with typical 4-flat (B).

V. STUDY OF PRINCIPLES GOVERNING EFFECTIVE OPEN SPACES

We pass now to a subject of even greater significance than plan efficiency, namely, that of ground coverage in respect to effective open space. Entirely too much emphasis has been placed upon percentage of ground coverage as an abstract matter. Tenement house codes and zoning laws have used percentage of coverage as a basis for plan regulation, often in a misleading manner. It makes little difference whether a building may cover but 60 per cent of an interior lot if its allowance of open space is largely unrelated in back yard space while narrow side courts cause dark rooms and do not afford outlook. A building may cover 80 per cent of the same lot and still be a better building. On the other hand scattered open space is far less desirable than the same space concentrated in one or two large courts properly related to all the rooms not fronting the street. Open space in courts is a distinctly illusive quality. For instance, the casual observer might think that Monroe Court (fig. 14d) is unnecessarily open and wasteful because of its 130 ft. square area, but he will find that the building covers nearly 50 per cent of its site; four units of the Metropolitan Apartments nearby may appear as far too crowded, especially in their narrow courts, yet they cover only 51.1 per cent of a site practically the same size and shape as the former example.

It has been demonstrated rather conclusively that, given freedom of planning and using a standard of room sizes between 175 and 200 square feet of gross building, the

This courtyard is 130 feet square, although the building covers 49 per cent of the plot, which is 190′ x 205′. It is an unusual example of simple perimeter planning and also illustrates the fallacy of overcrowding land as shown in the following pages.

INTERIOR VIEW OF MONROE COURT, SUNNYSIDE GARDENS, L. I.

CLARENCE S. STEIN, ARCHITECT

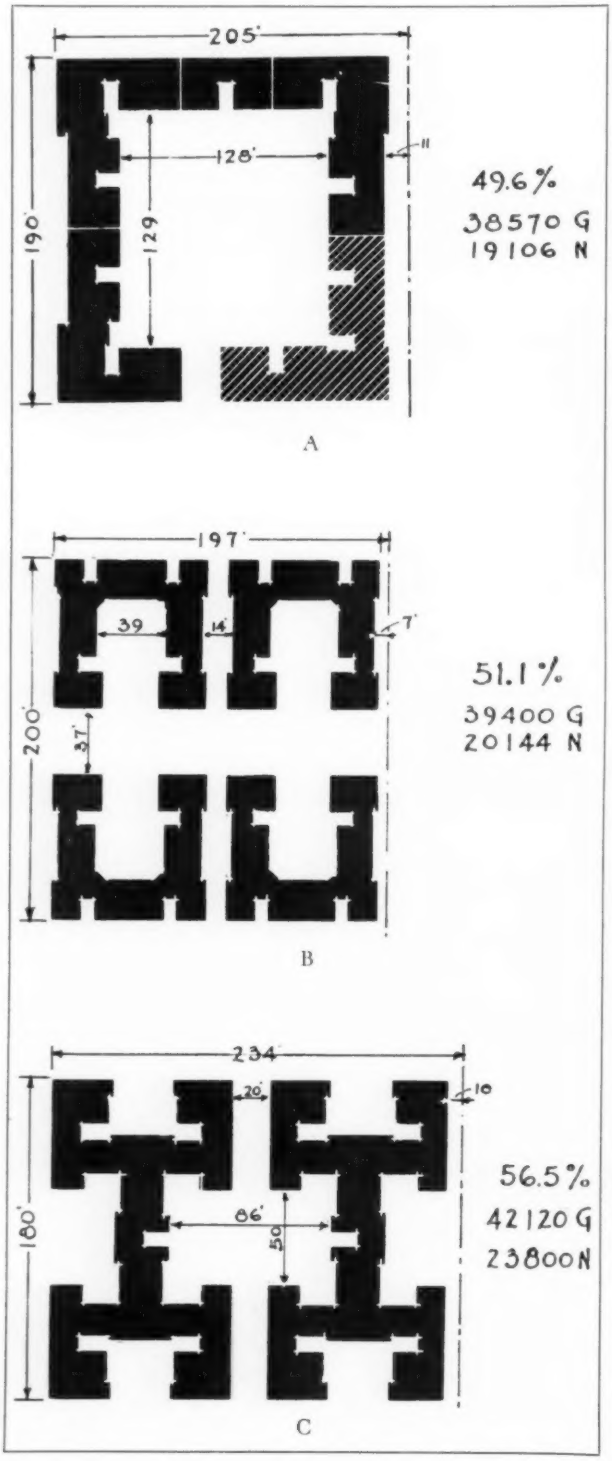
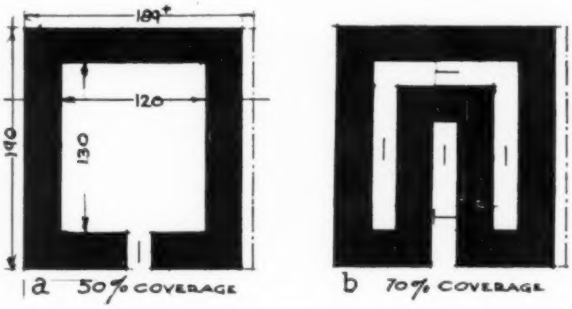


Fig. 14

COMPARATIVE EFFECTIVENESS OF GROUND COVERAGE IN VARIOUS PLAN TYPES

A = Simple perimeter; B = "U" court and C = "H" plan.

greatest plan efficiency is reached with a span depth somewhere between 28 and 32 ft. For convenience, let us assume 30 ft. as the average "span" depth for satisfactory two-room-deep planning. If we take the altered plan of Monroe Court shown on page 223, the site has an over-all size of 189.33'x190' (exactly 36,000 sq. ft.). If the



The maximum rent saving between a and b is less than $1.00 per room, per month, with land costing $4.00 per square foot.

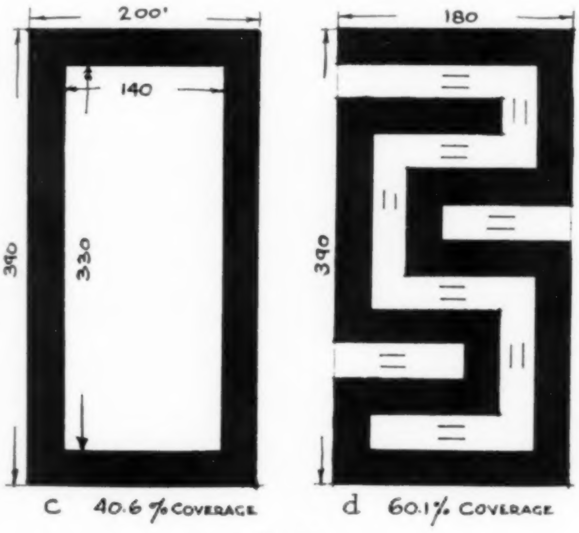


Fig. 15

span is 30 ft. and the building is extended to form a full square with one 20 ft. opening to the court from the street and with a 10 ft. side yard, the building will have an area of exactly 18,000 sq. ft. and will cover exactly 50 per cent of site (fig. 15a). The interior court will be 119.33'x130, a size which for convenience we will call

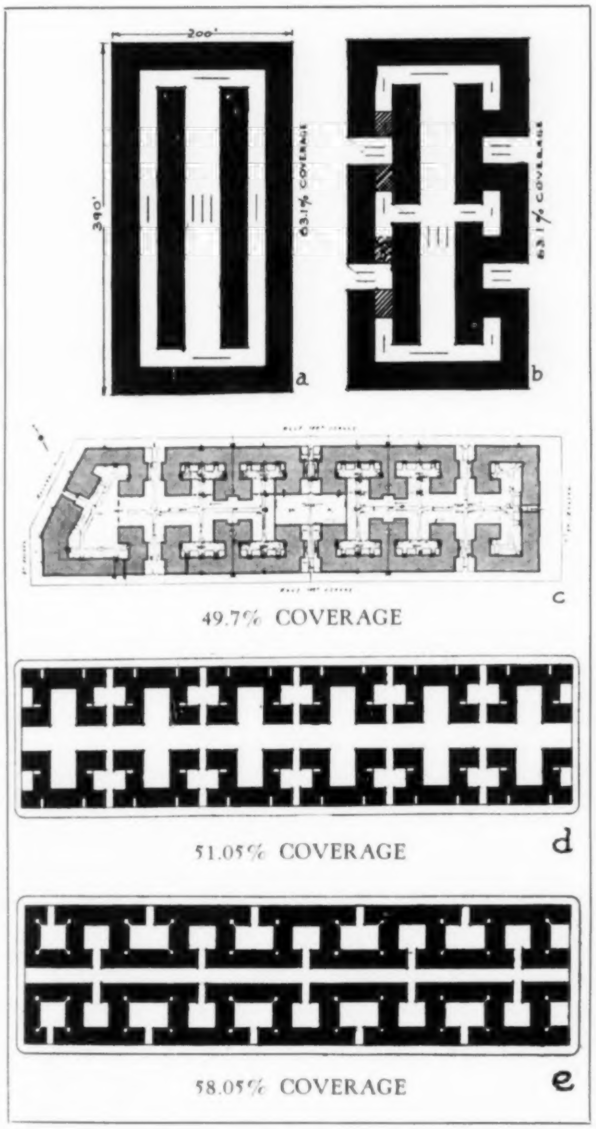


Fig. 16

120'x130' with an area of 15,600 sq. ft. If inside this court of 15,600 sq. ft. we erect a U court building of similar 30 ft. "span elements" (fig. 15b), this structure will reduce the 130 ft. court to three narrow light shafts, each 20 ft. wide. Thus we have added but 7200 sq. ft. of building area or 40 per cent, have entirely destroyed all openness, yet have covered but 70 per cent, or 20 per cent more of the site. It is therefore evident that for buildings of maximum plan efficiency, the range of land coverage lies between generous openness at 50 per cent and undesirable congestion at 70 per cent. This range of 20 per cent, even in non-elevator buildings of four or five stories, has a value of less than $100 per room in land costing $4.00 a square foot (or $500 a front foot, 100 ft. deep). The architect will hesitate to overcrowd his plan when he realizes that the maximum rent saving between figs. 15a and b is only about $1.00 per room per month. In the next illustrations (figs. 15c and d), we contrast on a site 200'x390' the full open court with a series of courts of 30 ft. exactly equal to the building depth. Again there is only a 20 per cent range.

As we are not advocating a design for a labyrinth, it will be advisable to study certain methods employed in large scale schemes in order to increase coverage. If the amount of building area to be had in the definitely limited perimeter is insufficient for his requirements, the architect naturally undertakes to add to his space by breaking back or doubling his perimeter. In simplified terms he may place alongside the perimeter, and at a minimum distance, another tier of rooms as in fig. 16a. This increases the coverage from 40.8 per cent to 63.1 per cent and reduces the court width from 120 to 40 feet. The result, however, is a fairly open plan suitable for an apartment building of four to five stories. In order to provide access and practical arrangement he must transfer certain parts, as in fig. 16b which contains exactly the same building area. This we term the "Double Perimeter Plan." Block plans which employ the principle may be cited as follows: the Paul Dunbar Apartments (c), by A. J. Thomas; the Astoria group of the Metropolitan Insurance Company (d), by the same architect, and (e) which is a scheme prepared for the New York State Housing Board by Arthur C. Holden Associates, architects. The last named has a 37'x52' court in each unit, but a space of only 24 ft. between the rear of opposite buildings. It

covers 58.33 per cent of the block, with a building span of 26 ft.

Now, unless the architect watches his procedure very carefully, he is likely to run into plan complications and inefficiencies which will almost, if not fully, counterbalance his saving in land cost. There seems to be no valid reason for crowding the land and reducing interior courts other than that of reducing the combined cost of building and land per room or apartment. Let us compare the simple open plan (fig. 15c) with the double perimeter plan (fig. 16b). In fig. 15c a room of 160 sq. ft. gross area in a five-story building will require 160 ÷ 5 ÷ 40.9′, or 78 ft. of land, which at $3.00 per foot is $234. If in complicating the plan as in fig. 16b it requires 170 sq. ft. of gross area for the same net size rooms (due to irregularities in the plan and considerable losses on the first floor for access to the interior parts of the building) the amount of land required in fig. 16b will be 170 ÷ 5 ÷ 63.3′ or 53.76 sq. ft. which at $3.00 per foot is $161. The saving in land, therefore, is $73 per room. But there is 10 x 11.4′, that is, 114 cu. ft. more of building cubage to build, which at 50 cents would cost $57 more per room. It is very doubtful, therefore, whether the remaining difference of $16 per room would pay for the added complications of plan in the double perimeter scheme.

The study of numerous examples where losses in plan efficiency have been caused by an effort to increase ground coverage leads to the assertion that *all complicated plan forms suffer through plan inefficiency and added building cost to a degree that is seldom recaptured by increased ground cover or overcrowding, even on land at comparatively high value.* It is probable that Mr. Stein's plans (e. g. Monroe Court), which have been casually criticized as being wasteful of land because of their very large inner courts, are in fact among the most efficient and most economically well-balanced buildings to be found.

VI. HEIGHTS, SUNLIGHT AND SET-BACKS

Ground coverage is a function not only of plan, but also of height or cross section; likewise of orientation. Here we must introduce a consideration of three dimensions or, may we say, four? Width, length, height, and direction. Again the percentage of coverage as an abstract maximum becomes absurd. A 60 per cent coverage, as we have seen (fig. 15d), gives just about an equal 30.30′ building span and court width. A 30 ft. court width is adequate for a 4-story

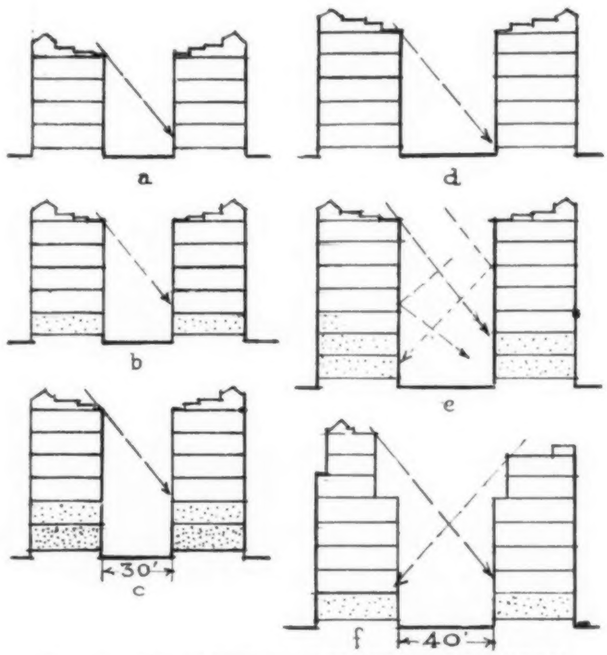


FIG. 17. SUNLIGHT IN RELATION TO STORY HEIGHT AND SET-BACK.

or perhaps even a 5-story height, but the same plan continued upward will result in bringing darkness to the lower stories. This matter is feebly covered by zoning provisions for increased width of light courts, related to heights, but here the minimums are so extremely lenient as to have very little beneficial effect.

Starting with a consideration of height only, with a plan of 60 per cent cover, a 30 ft. span, and a 30 ft. court, we find that at four stories sunshine is admitted to the

upper part of the first story windows at an angle of 45 degrees (fig. 17a). At five stories there will be one floor without winter sunshine for southern exposure (b). East and west exposures will have a short period of winter sunshine in the middle of the morning or afternoon. With six stories the first floor would be reduced to a twilight zone (c). In buildings over six stories the lower floors will be actually dismal excepting when set-backs are introduced above. It is probable that on very high-priced land, where a difference as between 55 and 60 per cent coverage may make a land cost difference sufficient to influence the plan, it will be desirable at times to increase the span depth from 30 to 35 feet. The plan losses may be partly offset by the usefulness of added closet and foyer space and bathroom placement on interior walls. A 40 ft. court spacing will admit only one more story of actual winter sunshine (d), with possibly two added stories (seven in all), which will receive slanting rays on east and west exposures (e). However, as the bulk of a court is enlarged, the diffusion of reflected light increases. Even the nine or ten-story building with a 40 ft. court may be practically as effective as a 30 ft. area for six or seven stories if some set-back is made in the upper stories (f).

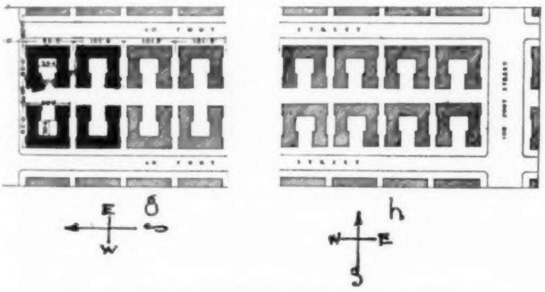


Fig. 18. ORIENTATION FOR SUNLIGHT.

Again in striving for plan openness we should be influenced by court direction. For instance, if a block of Metropolitan U courts had extended in an easterly and westerly direction, it would have been an advantage to sacrifice the pleasant effect of the doubled court (fig. 18g) for a larger proportion of apartments receiving direct sunshine, as in fig. 18h.

One of the most important points in the problem of suitable apartments for large cities in areas where ground rent becomes a matter of supreme consideration, is the subject of proper light and air, especially sunlight. All sorts of theories have been propounded. In New York much has been made of the set-back principle in height and bulk zoning. But though in office buildings and in business areas it has doubtless been effective, not only in whetting the imaginative instinct of designers but also in keeping an occasional ray of light and even sunshine upon our streets, it does not follow that the same principle will apply with equal effectiveness in the case of the tall apartment.

In the first place, economic factors have not yet forced New York to the extreme heights in these buildings notwithstanding the existence of certain tower edifices. A height of twelve to fifteen stories is still adequate for most locations. The proposals advanced in connection with the revision of the New York Dwellings law (see The Architectural Record, March, 1928, page 279) were of interest but gave rise to some doubt on the part of analytically-minded architects. While admitting that this law was conditioned upon the use of individual land holdings of a single frontage often of narrow width, one is forced to question at the outset the proposal to create a pyramidal form for habitation. All our studies point to certain rather definite maximum depths for the efficient planning of dwellings (varying with the size of room required). It becomes apparent, therefore, that if such efficiency is obtained in the upper part of the structure, where it is, say, 35 ft. deep, there is great danger of inefficiency and dark areas below that point where 10 ft. front and rear set-backs occur and where depth becomes 55 ft. (fig. 19a). The planning of a pyramid-shaped cap upon

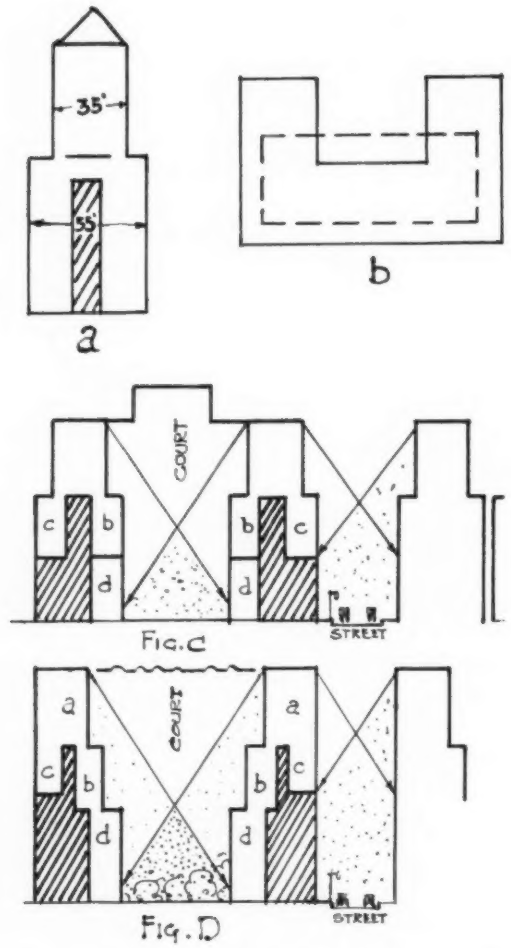


Fig. 19. DIAGRAMS SHOWING RELATIVE EFFECTIVENESS OF VARIOUS METHODS OF SET-BACKS ON APARTMENT BUILDINGS

a U-shaped sub-structure suitably planned for such efficiency is equally difficult to conceive (fig. 19b). Examples used at the time to show the working of the proposed scheme were based upon an ingenious arrangement of apartments with large rooms quite rectangular in shape. These rooms were perpendicular to the outside walls on the lower floors and parallel on the upper. In terms of large scale planning it would be more effective (assuming that the street was wide enough not to be greatly darkened by a twelve or thirteen-story structure), to apply the set-back at a lower level toward the court and again at the seventh or eighth floor, keeping the street front perpendicular. This would reduce the area of deep interior darkness and would increase the perimeter of the top stories more than sufficient to balance the loss in bulk of the base of building (fig. 19d).

Fig. 19c is based upon a front and rear set-back in which four stories on the street side fall below the sunlight angle. In fig. 19d the perimeters or sections (a and b) are both increased more than the compensation for the loss of one floor in "c" while "d" can be increased two stories in height before falling below the assumed two-thirds angle of sunlight. The actual dark space appears to be about the same in each case so that aside from the actual darkening of the street itself, there would be no loss. Large apartments in the "d" section would be planned with stairs, kitchens and other service rooms on the street side, or garage accommodation might be included.

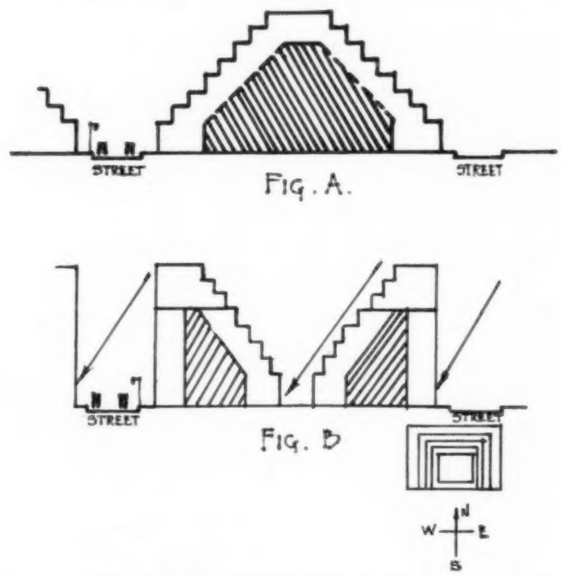
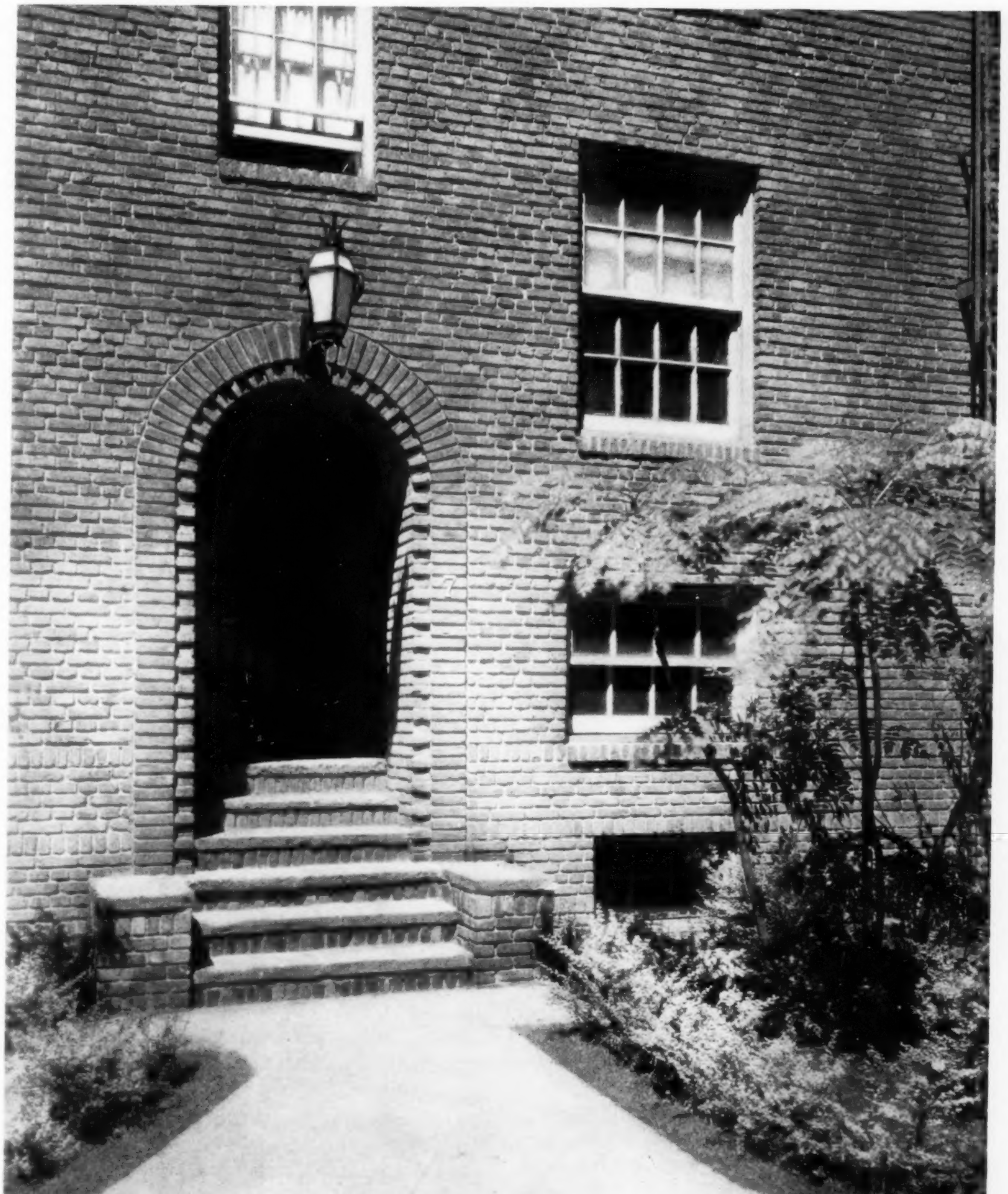


Fig. 20. DIAGRAMS SHOWING ADVANTAGE OF INTERIOR RATHER THAN STREET FRONTAGE SET-BACK

In the proposal of the architect Sauvage, of Paris, an apartment terrace is provided at every level (fig. 20A). The inner dark area of the pyramid could only serve a questionable use. It would be more effective to reverse the pyramid so as to bring a cone



Photo, Van Anda

ENTRANCE DETAIL
PAUL LAWRENCE DUNBAR APARTMENTS, NEW YORK CITY
ANDREW J. THOMAS, ARCHITECT

of light, the total length of the terraces, into the centre (fig. 20B). Stores, studios and service rooms would be toward the street while living rooms could be placed inward facing on terraced gardens flooded in sunlight. Theoretically, the south tier would be kept at a lower level.

VII. COMPARATIVE PLAN EFFICIENCY

Monroe Court exemplifies the advantages of a high standard of plan efficiency and simplicity. It has seventy-two rooms per floor and is four stories high. The adjusted plan (page 223) with seventeen apartments and seventy-two rooms, averaging 4.23 rooms to an apartment, surrounding a court 120′x130′, demonstrates the method of computing efficiency used in this article, in the following manner: Plan efficiency is found by deducting from the gross floor area, the area of all walls, partitions, entrance stair halls and other public halls and interior halls, or conversely, by adding the area of all usable space comprised in rooms, closets, bathrooms and foyers*.

Summary of Plan Efficiency Data, Monroe Court

72 rooms × 4 floors − 3 rooms (loss on first floor) = 285 rooms.

444.66 lin. ft. girder length × 30.33′ "span" depth = 13,488.3 sq. ft. area

13,488.3 sq. ft. × 4 floors = 53,953.2 sq. ft.

53,953.2 sq. ft. ÷ 285 rooms = 189.25 sq. ft. gross area per room

10,418 sq. ft. total area of walls, stair and entrance halls ÷ 285 rooms = 36.55 sq. ft.

189.25 − 36.55 = 152.7 sq. ft. per room usable space, i. e., 80.95% efficiency

The cost of this building in 1927 was slightly over 45 cents a cubic foot, or about $1040 per room. Land value was $240 per room. Rental scale, based on $17.50 per room per month for one year, is the lease in 4-room apartments.

We may now compare the 1925 Sunnyside units and the Paul Dunbar Apartments (see page 235). Both are taken as five stories high with 12″ brick walls. Sunnyside has the same proportion of first story losses as Monroe Court. These two plans have been chosen because their gross room size on the typical floor is almost identical and they serve to illustrate the differences between the "Simple Perimeter" and "Double Perimeter" plans.

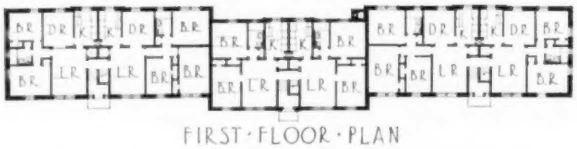
	Dunbar sq. ft.	Sunnyside sq. ft.
Area, typical floor	11,495.0	5026.0
Area, per room, typical floor	166.5	167.5
Net area, per room, typical floor	132.2	133.4
Area, per room, 5 floors	171.1	167.9
Net area, per room, 5 floors	132.5	133.0
Efficiency, typical floor	79.39%	79.88%
Efficiency for 5 floors	77.44%	79.21%

It will be noted how similar the two plans are in rating until the first floor entrance losses are accounted for. Finally, 171.1 sq. ft. gross area in Dunbar has 132.5 sq. ft. net usable area, or 77.44 per cent, while 167.9 sq. ft. gross area in Sunnyside has 133 sq. ft. net, or 79.21 per cent. There are, however, certain compensating factors. While Sunnyside has a large concentrated court, Dunbar has fairly satisfactory but less concentrated court areas with rooms that approximate a square and more rooms with double exposure.

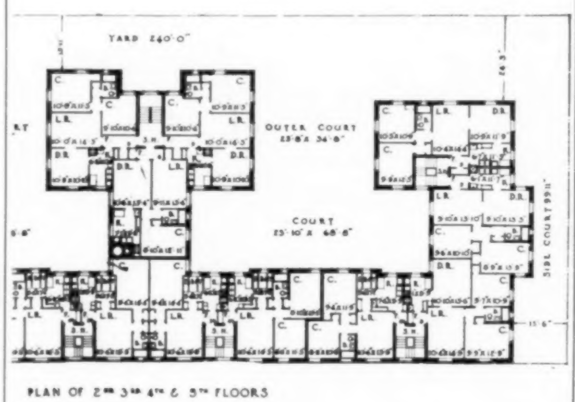
VIII. COST COMPARISON AND RULE OF THUMB DATA

We are aware of the difficulties in making reliable cost comparisons, due to variation not only in methods of planning and construction, but in the terms (cubic ft., etc.) in which costs are stated. As previously observed, there is in the group of buildings under consideration, a reasonable uniformity of method and a sufficient knowledge of cost facts reduced to a common basis of interpretations to offer results which should be of some value to those architects whose problems include the design of large, simply-arranged apartment groups. Some liberties and assumptions must necessarily

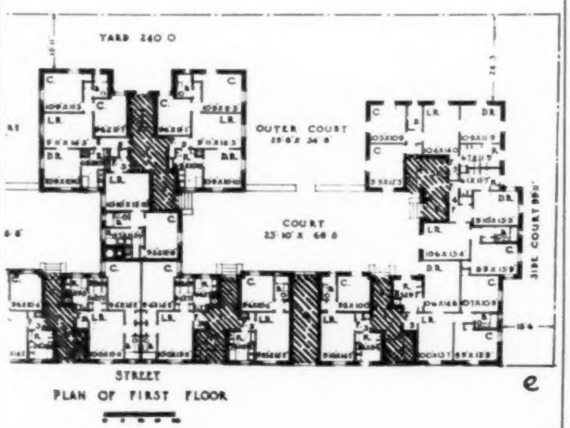
*Foyers only of reasonable shape and size are included. Long irregular foyers are a measure of plan inefficiency.



"A"—SIMPLE PERIMETER, SUNNYSIDE PLAN.
CLARENCE S. STEIN, ARCHITECT



"B"—DOUBLE PERIMETER, DUNBAR PLAN.
ANDREW J. THOMAS, ARCHITECT



"C"—DOUBLE PERIMETER, DUNBAR PLAN.
ANDREW J. THOMAS, ARCHITECT

be accepted and the tables set down are intended to be only approximate and should be so interpreted. *(See footnote, page 236).

Plan Areas and Cubic Contents

In simple two-room-deep buildings of from 26 to 32 ft. "span" depth, whether two-story multifamily or four-story apartments, the frontage width or "girder length" of reasonably efficient buildings will be found to fall within the limits of 5.75 to 7.5 linear feet per room.

Examples:

1. Small	Sunnyside (1925)	167 sq. ft.	5.88 lin. ft.
	Metropolitan (Dinettes = ½ room)	142 sq. ft.	6.09 lin. ft.
2. Medium	Monroe Court, as altered (page 223)	189 sq. ft.	6.15 lin. ft.
	Monroe Court, actual plan	195 sq. ft.	6.42 lin. ft.
	Michigan Boulevard Gardens, typical section	196 sq. ft.	6.23 lin. ft.
3. Large	Wilson Court (page 246)	200 sq. ft. gross	6.45 lin. ft.
	Jackson Heights, H Plan (page 219)	221 sq. ft.	7.40 lin. ft.

A fairly uniform relation between room sizes and "span" depth is indicated as follows:

	Span Depth (average)	Average Room Size (sq. ft.)
Metropolitan.......	25′.0″	142 Typical Floor
Dunbar	26′.0″	166 " "
1925 Sunnyside.....	29′.0″	170 " "
1927 "	30′.4″	196 " "
Mich. Blvd. Gardens	30′.6″	196 " "
Wilson Court......	33′.0″	200 " "

Of these various plans the most advantageous balance of all factors seems to require a 30′.6″ span for apartments of 190 sq. ft. gross per room, 4¼ rooms per apartment.

TABLE OF AREAS FOR THE 4.25 AND 3.25 RM. APTS., 190 SQ. FT. GROSS, AND 202 SQ. FT. GROSS

		4.25 RM.	3.25 RM.
Typical Floor per Rental Room	Span depth	30.5 ft.	(33 ft.)
	Girder length	6.25 lin. ft.	6.4 lin ft.
	Gross floor area	190.0 sq. ft.	202.0 sq. ft.
	Net floor area	159.0 sq. ft.	156.0 sq. ft.
	Outside wall perimeter	12.5 lin. ft.	12.8 lin. ft.
	Cubage—4-story building	2280.0 cu. ft.	2424.0 cu. ft.

Note: The above must be corrected for losses on entrance floor. Three-room apartments require a greater span of 33 ft. Because of the larger percentage of space per room required for foyer and bath room, 5 to 8 per cent more gross area is needed for the same size rooms.

be valuable in helping the architect to keep a check upon his work. If he specializes in apartment design he will acquire a procedure that will develop from year to year.

In considering efficiency he must add to the original list of factors referred to on page 217, the following plan elements:

a. Position and number of plumbing lines.
b. Position, number and access to dumbwaiters both for tenants and for basement service.
c. Position and number of fire escapes.
d. Access to incinerators if used.

Plumbing is made efficient by the combination of bathroom, sink vents and drains all on one short wall. The space occupied by pipes is also important. If the kitchen were placed elsewhere it might require additional width for furring pipes. The combination of dumb-waiter for two kitchens is efficient, although somewhat objectionable.

TABLE OF COMPARISON OF 4-ROOM AND 3-ROOM APARTMENT IN MONROE COURT

Two 4-Rm. Apt. with one stair occupies $50 \times 30.4 = 1517$ sq. ft. gross area
Two 3-Rm. Apt. " ½ " " $40 \times 30.4 = 1213$ " " " "

	Average net area per room	Bath-room, Closets	Foyers	Walls, Stair, Bath-Hall	Gross Area per room	Efficiency with Foyer	Efficiency—no Foyer	Cubage 4 stories	Cost @ 50¢
4-Rm. Apt.	132.2	14.7	2.5	40.1	189.5	78.8%	77.4%	2274	$1137
3-Rm. Apt.	129.3	18.3	8	46.6	202.2	76.9%	73.1%	2426	1213

The extra cost of the actual cubage in the three-room apartment is about $75 per room more than for the four-room. The greater cost of dumbwaiters, plumbing stacks and fire escapes, partly balanced by less stairway space, adds about $50 more or about $125 per room. On land at $4.00 per sq. ft., 50 per cent coverage, the extra land cost at four stories would be $25 per room. This is for the actual Monroe Court plan.

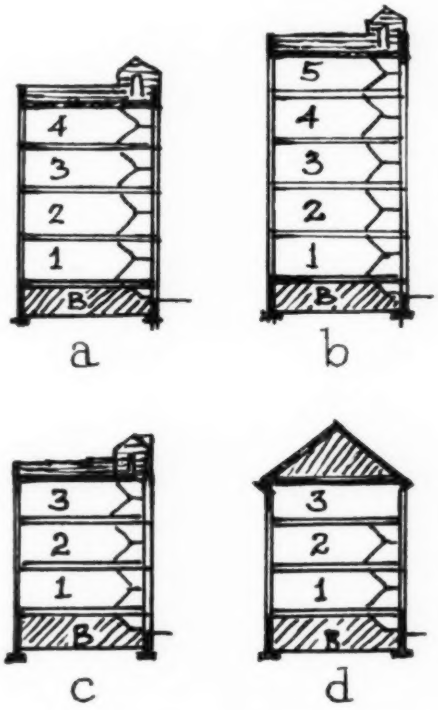
We do not wish to overstress plan-efficiency for its abstract merit, but it may

*The facts and methods of computation on which these comparisons are based are the result of extensive investigation and complete knowledge of cost factors in a number of large projects including studies made for the New York State Housing Board and particularly the 1925-26 construction of City Housing Corporation of New York which comprised 400 dwellings or apartments of about six million cu. ft. capacity built under uniform typical plans and construction conditions.

IX. AREA CUBAGE AND COST FACTORS IN RELATION TO STORY HEIGHT

Quite as important as plan efficiency is the study of the comparative efficiency of story heights. A uniform height of nine feet from floor to floor is assumed in these computations, with twelve feet added for the basement and roof or parapet. A fairly complete study of cost breakdown in certain buildings indicates that when the total cost on the above basis is 45 cents per

cubic foot for four stories, the basement and roof should be calculated at 30 cents, that is, instead of 48 ft. high x 45¢ = \$21.60, we should figure 30¢ x 12′ = \$3.60, and 36′ x 50¢ = \$18.00. Total \$21.60. This is at least a handy method more accurate than using either 45 cents or 50 cents for all buildings, whether three, four or five stories high and results as follows:



DIAGRAMS SHOWING PROPORTION OF BASEMENT AND ROOF SPACE TO "USE AREA" IN WALK-UP APARTMENTS OF VARIOUS HEIGHTS.

3 Stories 3 × 9′ = 27′ × 50¢ per cu. ft. + 12′ × 30¢ ÷ 39 = 43.8¢ cu. ft.
4 Stories 4 × 9′ = 36′ × 50¢ per cu. ft. + 12′ × 30¢ ÷ 48 = 45¢ cu. ft.
5 Stories 5 × 9′ = 45′ × 50¢ per cu. ft. + 12′ × 30¢ ÷ 57 = 45.7¢ cu. ft.

It is frequently forgotten that although three-story buildings cost more per room than five-story ones, they cost less per cubic foot because there are more cubic feet of basement and roof in comparison with finished space.

This ready method has been checked against the actual cost breakdown of known buildings and seems to indicate that in a four-story building 190 sq. ft. gross area per room costing 45 cents a cubic foot or \$1026 per room, the reduction of one story will add about \$55.86 or 5½ per cent for building while the addition of a story will reduce the cost about \$36.14 or 3½ per cent. Therefore,

4 stories cost (2280 cu. ft. × 45¢) = \$1026
3 stories cost (2470 cu. ft. × 43.8¢) = \$1081.86 = + 5½%
5 stories cost (2166 cu. ft. × 45.7¢) = \$986.86 = − 3½%

There remain such factors as public improvements, utility, connections and landscaping which make it safer in practice to increase this variation to 9 per cent more for three stories and 5 per cent less for five stories.

X. ECONOMIC FACTORS IN APARTMENT DESIGN

Up to this point we have been concerned with the comparative efficiency of plans and the relative cost of producing usable space in apartment buildings of various sizes, shapes and heights. These are questions about which every architect makes it his business to acquire dependable data. Since apartment buildings are usually built for investment, we must take into account additional factors such as the relation of building space and cost to the cost of land and to the variable and complex elements of maintenance. The inter-relation of all these factors resulting in their efficiency expressed in terms of rent, constitutes the economic problem of apartment design. Rent is a subject about which the architect is normally expected to know very little. In fact his problem usually comes to him from the owner or promoter with its general limits specified as to size, height and even arrangement. Because of this limitation he is perhaps too ready to have the responsibility for financial success fall entirely upon the client who is "putting up

the money." This condition has its disadvantages. The architect in reality is both practically and temperamentally capable of rendering service other than the mere production of the working drawings. He can, and should, help to analyze and solve the economic problem. He may reasonably expect the promoter to know his mind as to the kind of apartments that are needed or will rent to advantage, at a rental suitable for the district in question, but the architect should be able to advise as to the plan disposition and height of building which will furnish, *not the most space**, *but the most economically efficient arrangement of desirable rental space at the rentals desired.* He must be capable of differentiating readily between the kind of plan suitable for apartments of seven rooms and two baths and that suitable for three rooms and one bath. He should have a clear idea of the effect upon rentals, as well as upon cost of larger or smaller rooms, of simple plans with minimum services, or of complicated plans and maximum services. Otherwise the architect cannot direct the production of a really successful undertaking.

Here again we find the architect's position in a state of change. The promoter seldom works in a scientific manner, but relies upon experience. Having built apartments over a period of years, using similar plans and on similar city lots, he is in a position to discover which plan is the most popular, the most profitable and the easiest to operate. He would find it impossible to explain the advantages of one plan over another. In approaching a problem where conditions are fairly similar to those with which he is acquainted, he proceeds with a degree of intuition which is usually dependable. Apartment houses, however, are undergoing changes. Small city lot locations are being supplanted by more complex suburban block conditions. The trained promoter has therefore less to guide him in the way of precedent and is inclined to carry over those methods which no longer apply. He still continues to crowd land where crowding is less excusable than in congested areas.

*That practice of loaning institutions still persists by which the amount of first mortgage loan is based on the cubic volume of the building. This has led to a disregard for efficiency. The larger the floor plan the larger the loan. A certain amount of useless space has consequently become chronic in our current plans merely because one cannot obtain as large a loan on the more efficient building.

Just how the architect may cope with the new problems of a less rigid setting is an open question. When directly called upon, he may have a vague knowledge of the economic factors which should control his plan. Should he set up a real-estate expert in his already crowded office and combine forces with the realty specialist? This will gain him little.

The architect has a method of working which he comes by traditionally. He is neither so precise as the engineer, nor does he depend mainly upon intuition as does the promoter. He may be compared to the cook who, given the proper ingredients, can produce a delectable dish even though she may not stop to measure every part of the mixture. If he depended upon a refined exactitude as a basis for his mental processes, it might be dangerous to attempt to assemble for his use the rough and ready sort of data for which the previous chapters serve as a foundation. But relying upon the balance of his practical and intuitive judgment we here offer merely for his convenience a few rough and ready rules which may aid in the improvement of his technique.

In the use of the term *rent* we include the full return on the property which is frequently divided between ground rent and building. For convenience we will relate the subject to the foregoing by a series of generalized data providing a reasonable factor of safety to compensate for the very severe standards of efficiency previously suggested.

200 sq. ft. of gross area per rental room will provide amply for an average of 4 rooms and a size of 150 sq. ft. net, with suitable foyer.

50 cents per cu. ft., or $1200 per room cost for 4-story height will allow a margin to provide for attractiveness in public halls and excellence of finish.

Our base will be again 4 rooms, 4 stories at 9 ft., floor to floor.

50 per cent land coverage or 400 sq. ft. per room 4 stories in height gives a site cost of 100 × price per sq. ft. of land.

In rural areas, substitute a standard of 3 stories and 33 per cent coverage requiring 200 × sq. ft. price of land.

Rent and profit are determined by a combination of four basic factors: (1) Carrying charges on land cost, (2) carrying charges on building cost, (3) financing, and (4) maintenance. For analysis it is convenient to group financing costs under land and building respectively, including a reasonable return or profit on the investment involved in each field. The items of losses due to normal vacancies and renovation are grouped under maintenance.

Thus land charges include Interest, Financing, Taxes, Site Development.

Building charges include Interest, Financing, Taxes, Depreciation or Amortization.

Maintenance charges include Management, Services, Vacancies and Renovation.

Because of the wide variation in high financial bonuses and wide margins of profit necessary to absorb risk, bad judgment and unfortunate extravagance of tenants, it is necessary to use for reliable comparison a type of moderate but adequate financing which is perhaps not so typical of actual practice as might be desired.

We will allow 10 per cent on the actual cost of both the land and building to cover the cost of financing and carrying charges until the building is ready for occupancy and 7 per cent interest plus 2½% for amortization and depreciation of building cost* should be sufficient to pay for loan renewals, interest on 60 per cent first mortgage, interest on and retirement of second mortgage in ten or twelve years, and pay about 8 per cent on the equity. If the building is well managed and vacancy losses do not exceed allowance in maintenance budget, the owner should receive an increased earning on his equity after this time. Larger margins are frequently allowed and suburban locations may have to pay higher rates on reduced proportion of first mortgages. These assumptions are, however, sufficiently representative for our purpose for projects in Eastern areas.

*This division of 7 per cent interest and 2½ per cent for amortization and depreciation is an arbitrary but convenient manner of separating the charges which appertain to land and building costs. It represents a complete series of factors which include profit in the return on the owners equity and a continually changing relation between interest and amortization due to the liquidation of both first and junior mortgages. Its application may be checked by studying this table in relation to typical example, page 245.

Applying the above to a Typical Project

Costs:

200 sq. ft. gross area $\times \dfrac{36+12}{4}$

2400 cu. ft. at 50¢ building cost = $1200 per rental room

200 sq. ft. 50% cover

$= \dfrac{400 \times}{4}$ $2.00 Land Cost	=	200	" " "
10% Financing and carrying charges			
Building	=	120	" " "
Land	=	20	" " "
Site improvements and contingencies		60	" " "
		$1600	Cost at rental opening

Annual Charges:

Interest 7% × $1600	$112.00	per room
Amortization 2½% × $1380	34.20	" "
Taxes 2% on full value	32.00	" "
Maintenance	45.00	" "
Vacancies 7%**	16.80	" "

$240.00 per room per year
$20.00 per room per month

**The allowance for Vacancies in our maintenance budget should be only enough to cover rent losses due to the normal change of tenants and seasonal factors. Some financiers allow a much larger factor of safety at this point, but this is obviously erroneous since it would be equivalent to a merchant marking up the prices of his goods because they did not sell.

For purposes of comparative study it is preferable to change this listing to the following:

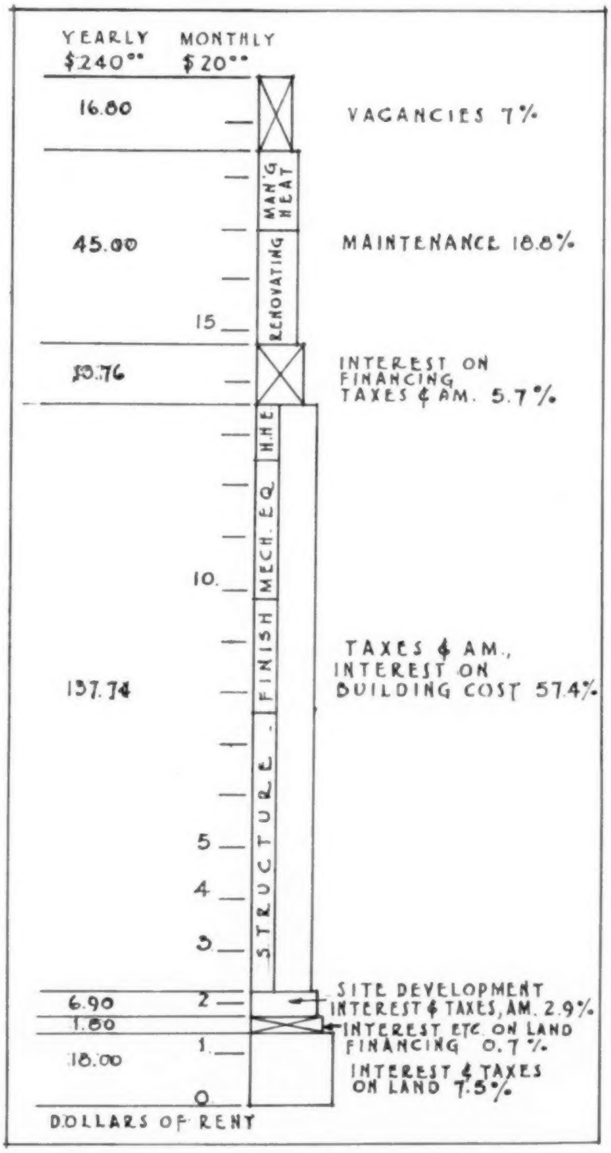
Annual charges on land	
x (\$200) + 10% × 7% + 2% = ...	\$ 19.80
Annual charges on building and site improvement y (\$1200) + 10% (+ \$60) * × 7% + 2½% + 2% = ...	158.40
Maintenance†	45.00
Vacancies	16.80
†(See footnote, page 245).	
	\$240.00

Note: This compares favorably with the experience of a company owning and renting a number of 4- and 5-story walk-up, 50 per cent coverage apartments, costing about \$1075 per room for building and on land valued and taxed at about \$2.50 per sq. ft., or \$1425 total per room, maintenance and vacancies figured at \$60 per room. Rentals are based on \$17.50 per month or \$210 per room per year for 4-room apartments. The buildings are considered an excellent investment. Interest, amortization and taxes at 11½% on the \$175 difference = \$20, which, added to \$210 = \$230 per year or \$10.00 less than estimated above.

These factors can best be followed by reference to the Rent Barometer (fig. 21). Here the monthly rent dollar is set alongside a graphical scale of the annual charges. It shows at once that the 50 per cent coverage four-story building is not excessively extravagant on land costing \$200 per front foot, 100 feet deep. The site factor, including landscaping, requires only slightly over \$2.00 or 10 per cent of the monthly rent. \$400 land at same coverage would add \$19.50 ÷ 12 = \$1.65 per room, per month. If at this point the owner has become anxious about his rental returns and wishes to reduce the \$21.65 to \$20.00 per month again, one of the most questionable ways of proceeding would be to increase his coverage from 50 per cent as in fig. a, page 228, to 70 per cent as in fig. b.

The result would be
200 ÷ 70 ÷ 4 × \$4.00 = \$285.70 per room,
as compared with
200 ÷ 50 ÷ 4 × \$4.00 = \$400 per room.

This saving of \$114.30 per room, + 10% × 7% + 2%, will save only \$11.31 per year or less than \$1.00 of the \$1.65. He would also reduce the sunlight and the outlook from 80 per cent of the rooms which would aggravate rather than improve the situation.



· RENT · BAROMETER ·

Fig. 21

The next logical step would be to try to save on the cost of the construction. Here a reduction of \$125 per room would save \$125 + 10% × 7% + 2½% + 2% = \$15.80 or

*Site improvement costs are here included with building cost so as to be amortized. No carrying charges are added for this item.

$1.31 per month. Perhaps the owner might find a friend willing to make a loan which will cut his average interest rate 1 per cent. This will save 1 per cent of $1600 or $16.00 per year, $1.33 per month. But by far the most hopeful way to proceed would be to attack the matter of maintenance. If he could eliminate his vacancies, he would save $16.80 which is more than either 1 per cent on interest, or $125 per room building cost, and much more than he would save by crowding his land from 50 to 70 per cent coverage. But, of course, some vacancies are almost unavoidable.

After all, we resort to maintenance as our only hope. Some of the largest items in maintenance are due to the shifting habits of tenants. About $30.00 per room per year or half of the maintenance allowance is for repairs, re-decoration, and vacancies. If people moved less we would not only reduce these items but save also on the cost of re-renting. One company managing a number of buildings of this class allows a bonus of 15 per cent reduction to three-year leases. This means nearly $2.50 per month rent reduction for each room. The low rental thus established has almost eliminated vacancy losses and reduced renovation to a moderate sum. This means that the tenant must take better care of the property and at times do some painting and repairs himself, or the property, if let run down, will cost more for repairs in the end. A more effective remedy would be to produce better buildings. Some form of fireproofing must be perfected that is not too costly and which will be proof against plaster-cracking, vermin, and, let us hope, against sound transmission. This would automatically reduce maintenance and quite possibly more than pay interest on the increased first cost. New York, unfortunately, has an antiquated building code which still permits six-story non-fireproof buildings. Now that builders are installing elevators in such structures the danger is further increased. When, like Chicago and certain other cities, we fix a reasonable limit (three stories in Chicago) on non-fireproof buildings, we shall be able to look for advancement in apartment house construction in keeping with other modern structures.

Even if we should fail thus to reduce rents, our buildings will certainly be better worth the rents which must be charged. In any event the maintenance factor is one of great importance in the design as well as in the conduct of the apartment.

To recapitulate:

Problem—a building of 4 stories costing $1380 per room financed and with $440 also financed for land (at $4.00 a square foot net), with maintenance and vacancies allowance, is estimated to rent for $21.65 per room per month: How can we reduce it $18.00 per year or approximately to $20.00 per room per month?

Possibilities in order of desirability and effectiveness:

	Per Room
1. Reduce maintenance costs by saving 50 per cent in items of renovation, rent losses	$18.00 per year
2. Reduce cost of money (average interest rate) 1 per cent on cost per room	18.20 per year
3. Reduce the building cost $125 per room	15.80 " "
4. Crowd the land to 70 per cent instead of 50 per cent area	11.31 " "

Numbers 3 and 4, especially 4, make the buildings so much less desirable that it will probably be more difficult to rent at $20.00 than at the $21.65 for the original set-up.

Without further pursuing the controversial elements of the subject we now propose to put to a test the application of the data and methods which have been discussed.

XI. SCIENCE vs. IMAGINATION

Each designer should have some system as a basis for procedure which will avoid the disappointments of the usual trial and error method. Any system which proves of use and which can be refined over a period of years of practical application should stimulate the designer's imagination. The data and rules given in Sections VII and VIII should result in a system suitable to model tenement planning and may be illustrated by application to the following hypothetical problem.

PROJECT: An owner without too many predisposed opinions has purchased a site 250x192 ft., for $120,000 (48,000 sq. ft. at $2.50 per square foot) in a high class suburb. He desires to erect on it an apartment building as an investment, and believes that it should be of an attractive character suitable to its surroundings. An elevator project is deemed undesirable as it involves responsibilities difficult for a private owner to meet.

Basic rentals to be aimed at are $24.00 per room for four rooms in 4-story buildings. The owner is sufficiently confident of the stabilized character of the neighborhood to be willing to receive as his profits a reasonable return on his equity (to be limited to the cost of the site, $120,000) over a period of fifteen to twenty years, and can thus provide for such amortization of loans as will secure favorable financing.

PROBLEM: What type of open or closed plan and range of heights averaging four stories or less if possible, will best answer his purpose?

PROCEDURE: The architect with the aid of his system first proceeds to determine scientifically the bounds within which he can work as follows:

For rentals of $24 per room per month, fair-sized rooms are required with about 175 sq. ft. net area per rental room which, on a 4-room, 4-story base, 76.5% efficiency (ample for good foyers and closets) gives as a *base:* 228.5 sq. ft. gross per room, 2740 cu. ft. at 50¢ (ample in N. Y. area for good construction) $1370 per room building cost, 7.47 linear feet per room building length for 30′6″ span depth (which should provide approximately square, well-shaped rooms); maintenance and 7 per cent vacancies may be taken at $66.00* per year. Buildings of three stories should rent at an average of $1.00 more per room and require 50 cents more for maintenance; 5-story buildings, because of resistance to higher climb should rent for an average of $1.50 per room less and require 50 cents less for maintenance. The following table may serve as a guide:

TABLE OF VARIATIONS ON A 4-ROOM, 4-STORY APARTMENT BUILDING

Base, 228.5 sq. ft. gross.
Rent, $24.00 per room per month.

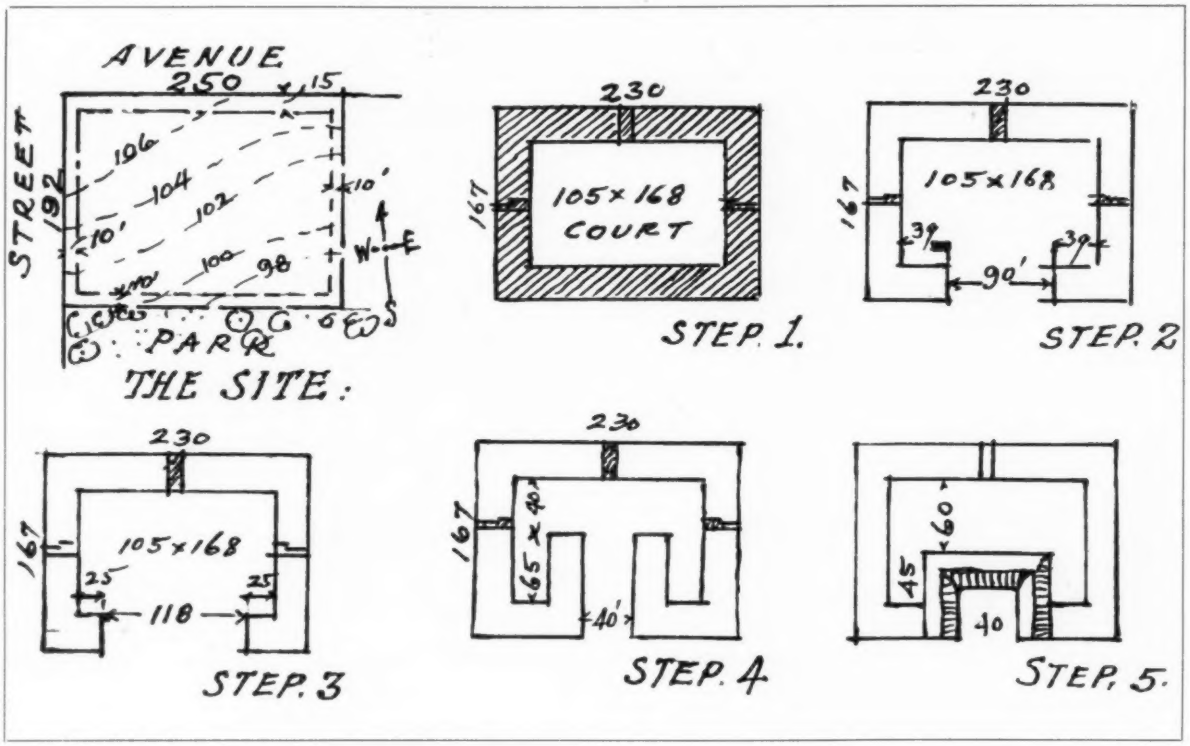
	3 Stories	4 Stories Base	5 Stories
Building Cost per room	$1493.0 (+9%)	**$1370.0**	$1301.50 (−5%)
Rental per room per year	300.0	**288.0**	270.0
Maintenance per room per year	72*	**66***	60.0*
Carrying Charges of Bldg. only 10% × 7% + 2½% + 2%	188.86	**173.30**	164.64
Net Balance available for Carrying Charges on site cost	39.14	**48.70**	45.36

The 4-story height is indicated as the most favorable. However, for the sake of interest and domestic quality, half three and half four will be attempted.

Site cost is $120,000; public improvements, $14,000; landscape, $17,500=$151,-500+10% financing × 7%+2%=annual carrying charges for site $14,998.50.

Total number of rooms per floor=43% 3-room at $39.14, 57% 4-room at $48.70 each or an average of $44.58 per room available for X site. $14,998÷44.58=336+

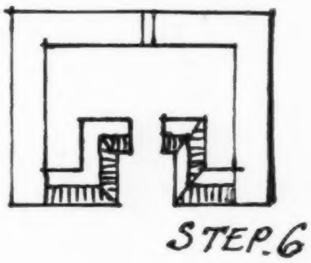
*(See footnote, page 245).



rooms. These will be divided in 144 rooms in 3-story and 192 rooms in 4-story buildings or 96 + rooms per floor.

Average linear foot of building length required per room 7.47x96 rooms = 717.1 linear feet + 22.9 feet for ground floor losses = 740 lin. ft. of building required. Same process for all 4-story building \$14,998 ÷ \$48.70 = 308 rooms ÷ 4 = 77 rooms × 7.47 = 575 + 15 feet for ground floor losses = 590 linear feet of building required.

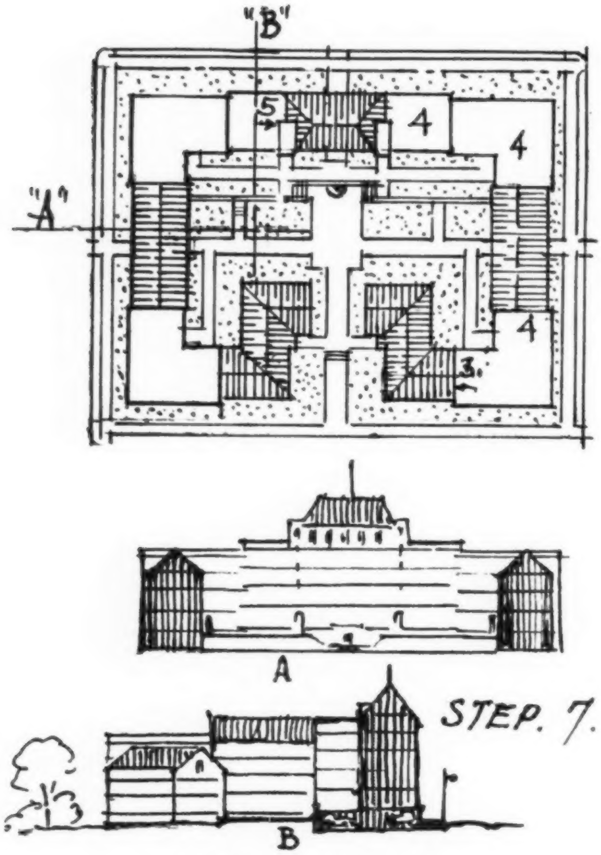
Q. E. D. We need therefore in our design either 740 linear feet of building length for 3½ stories or 590 for 4 stories or any variation between. Plotting our site carefully with such considerations as grades, slopes, orientation and building set-backs, and bearing in mind the demonstrated efficiency of the simple perimeter plan, we find that our maximum perimeter is 670 linear feet for a building of 30.6 depth (Step 1). This is too little for our 3½ story building which requires 740 feet, but the all over 4-story plan requiring 590 feet may be used, leaving



Scientific Stages in Solution of an Architectural Problem

an opening 80 feet wide to the south side (Step 2). Two-thirds of four and one-third of five stories would work out about 38 feet less as in Step 3.

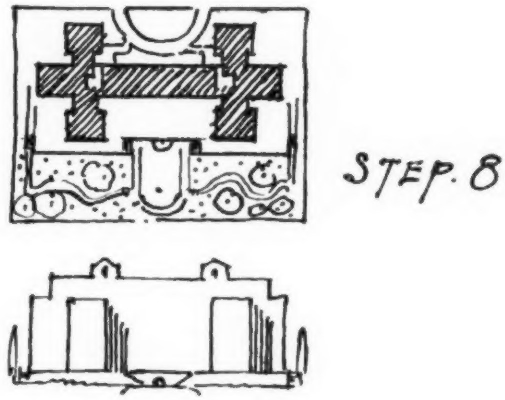
On a basis of pure science and mathematics the 4-story building will return the most profit at a given percentage of vacancies, but then, for many reasons of interest and appropriate domestic character we may still prefer the combined 3- and 4-story design. The next step is to increase the perimeter by internal extension as in Steps 4, 5 and 6 or until finally, both for a better court and for architectural interest, the plan is adjusted to the area indicated in Step 7,



IMAGINATION APPLIED

with a narrow tower of five stories. Thus far the designer has proceeded with assurance that his financial basis is secure. Before finally adopting his plans he may permit imagination to prevail over science and try out various other schemes such as indicated in Step 8 which secures 340 rooms in a 7- and 8-story building similar to the Kelvin Elevator Apartments (page 279).

To test the validity of our financial set-up and to explain more clearly its elements, we will adopt the plan represented by Steps 5 and 6 (with slight variations necessary to provide for correct stair locations and proper proportioning of various size apartments). This results in 338 rooms, 196 in 4-story, and 142 in 3-story buildings, with slight gains in the actual efficiency of the plan.



Financial Set-up of 3 and 4-Story Scheme

Land, Public Impr. and Landscape	\$151,500+10%	\$166,650
Building Cost:		
196 rooms × 1370	268,520+10%	
142 rooms × 1493	212,000+10%	528,570
Total cost	\$632,020+10%	\$695,220

1st Mortgage loan—\$400,000, 58% @ 5½%, 1% per year amortization

2nd Mortgage loan—\$170,000, 25% @ 6%, 1% year comm. 8⅓% amortization

Equity—\$125,220 to earn an average of 10% per year

Short Method of Calculation

Expenses:	
Land, etc.—\$160,000 × 7% + 2% =	\$14,400
Building—\$528,600×7%+2½%+2% =	60,788
Maintenance and Vacancies	
196 rooms @ 66*	12,936
142 rooms @ 72*	10,224
Total expenses	\$98,348
Income:	
196 rooms @ 288 per room = \$56,400	
142 rooms @ 300 per room = 42,600	
	\$99,000

*(See footnote, page 245).

This short method is merely for convenience in roughly checking a project in its various stages of study—both the 7 per cent and 2½ per cent represent interest, amortization, depreciation and profit which are constantly changing each year in the life of a building. It may seem difficult to understand how 7 per cent interest and 2½ per cent amortization (2 per cent = taxes) can provide 6½ per cent on the first mortgage, 15⅓ per cent on the second mortgage, 1½ per cent for depreciation and a fair

return on the equity. But this is just what it does, as will be seen in the "Long Method of Calculation" below. The 7%+2% and 7%+2½% is a more convenient way of separating the costs and profits applying to the land from those of the building so that we can readily follow the influence of these two factors upon the annual rent.

But before we finally adopt a budget of rent and expenses we must carry the matter to a more careful conclusion, which is here given for three periods in the first twenty years of operation. It provides for starting with a $24.00 per room base rental and reducing the rents 5 per cent after six years and 5 per cent more after twelve years. The first mortgage is amortized 1 per cent a year for twelve years and 2 per cent a year for eight years or a reduction of about 30 per cent during the period. The second mortgage is amortized entirely in the first twelve years or 8⅓ per cent per year; 6 per cent interest and 1 per cent per year renewal commission is provided. The good terms and reasonable commissions are commercially possible only where the owner, as in this case, is willing to take his own profits slowly at first and also provides a sinking fund for depreciation. Just what the owner actually profits from a building is the crux of apartment building. The man who can bide his time is in the strongest financial position.

Detail of Operating Budget Income and Rents of Hypothetical Project
(over a period of 20 years)

	Years 1-6th	Years 6-12th	Years 12-20th
1st Mortgage $400,000 5½% Int. 1% Amor.	$25,340	$24,000	$25,600 (2% am)
2nd Mortgage $170,000 6% + 1% + 8⅓% Amor.	23,091	17,141	00,000
Taxes 2% on entire cost	13,770	13,770	13,770
Depreciation 1½% on Bldg. Cost	6,920	6,920	6,920
Maintenance*	16,116	16,116	16,116
Vacancies about 7%	6,760	6,760	6,760
	$91,997	$84,707	$69,166

Rental Income 1-6th Year $99,000 − $91,997 = $7,003 = 5.6% on equity

6-12th year (5% less rental) $94,050 − $84,707 = $9,343 = 7.46 on equity

12-20th year (again 5% rental reduction) $89,100 − $69,166 = $19,934 = 15.91% on equity

In the first twelve years the owner has paid off:

On first Mortgage	$ 48,000
The entire second Mortgage	170,000
Set aside for depreciation	83,000
Paid interest to himself of	98,000
or a total of	$399,000

At the end of the first six years he has reduced rents 5% and at the end of twelve years he is ready to reduce them 5% more; that is, from $288.00 per year originally, to $273.60, and if he keeps his building up (he may use for improvements some of the $83,000 depreciation fund) and can keep it rented, he will receive an income of 15.95% or nearly $20,000 per year on his original equity of $125,000.

The application of the same process for the 4 and part-4 and 5-story buildings will show a net profit considerably greater than for the 3- and 4-story scheme. In fact, Step 7 will show an increase over Steps 5 and 6. The most important factor of all, however, is that of vacancies, and if the 3- and 4-story scheme should, because of its character in relation to the neighborhood, show a low average of vacancies, it would probably net as much in the end as the other schemes requiring more rooms and a heavier investment.

The subject is indeed complex. The suggestions and calculations in this article are necessarily incomplete but certainly they go to show that apartment house building merits greater attention by the architect, both in efficiency of planning and intelligence of operation.

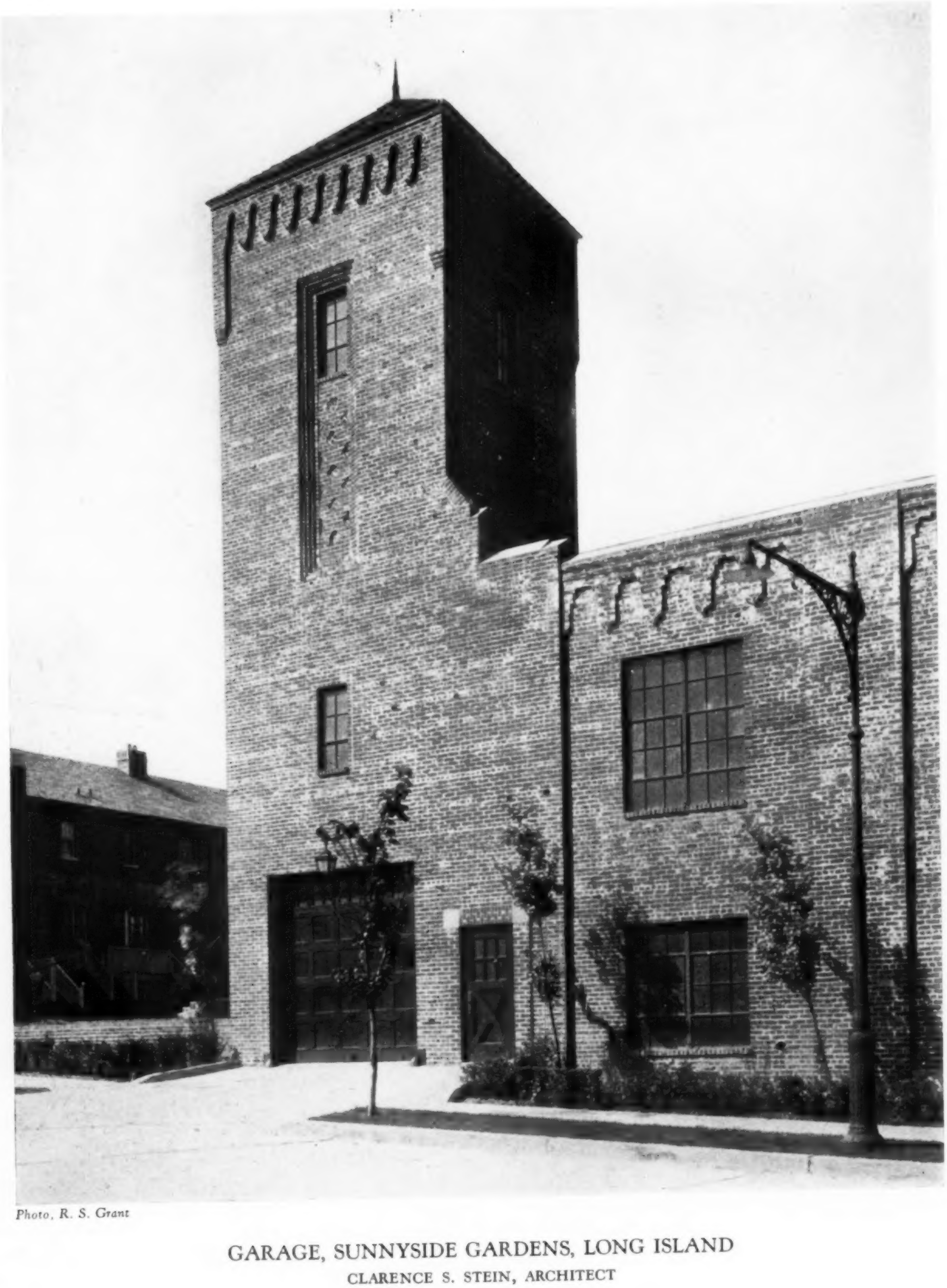
*†The maintenance figures used in these schedules and in the Rent Barometer are based upon large projects of a non-commercial nature. For commercial practice and especially for smaller projects, maintenance allowance should be increased at least $12.00 per year adding $1.00 per month to the necessary rental rate.

Photo, R. S. Grant

DETAIL, FRONT FAÇADE
WILSON COURT, SUNNYSIDE GARDENS, LONG ISLAND
CLARENCE S. STEIN, ARCHITECT

Photo, R. S. Grant

DOORWAY DETAIL
WILSON COURT, SUNNYSIDE GARDENS, LONG ISLAND
CLARENCE S. STEIN, ARCHITECT



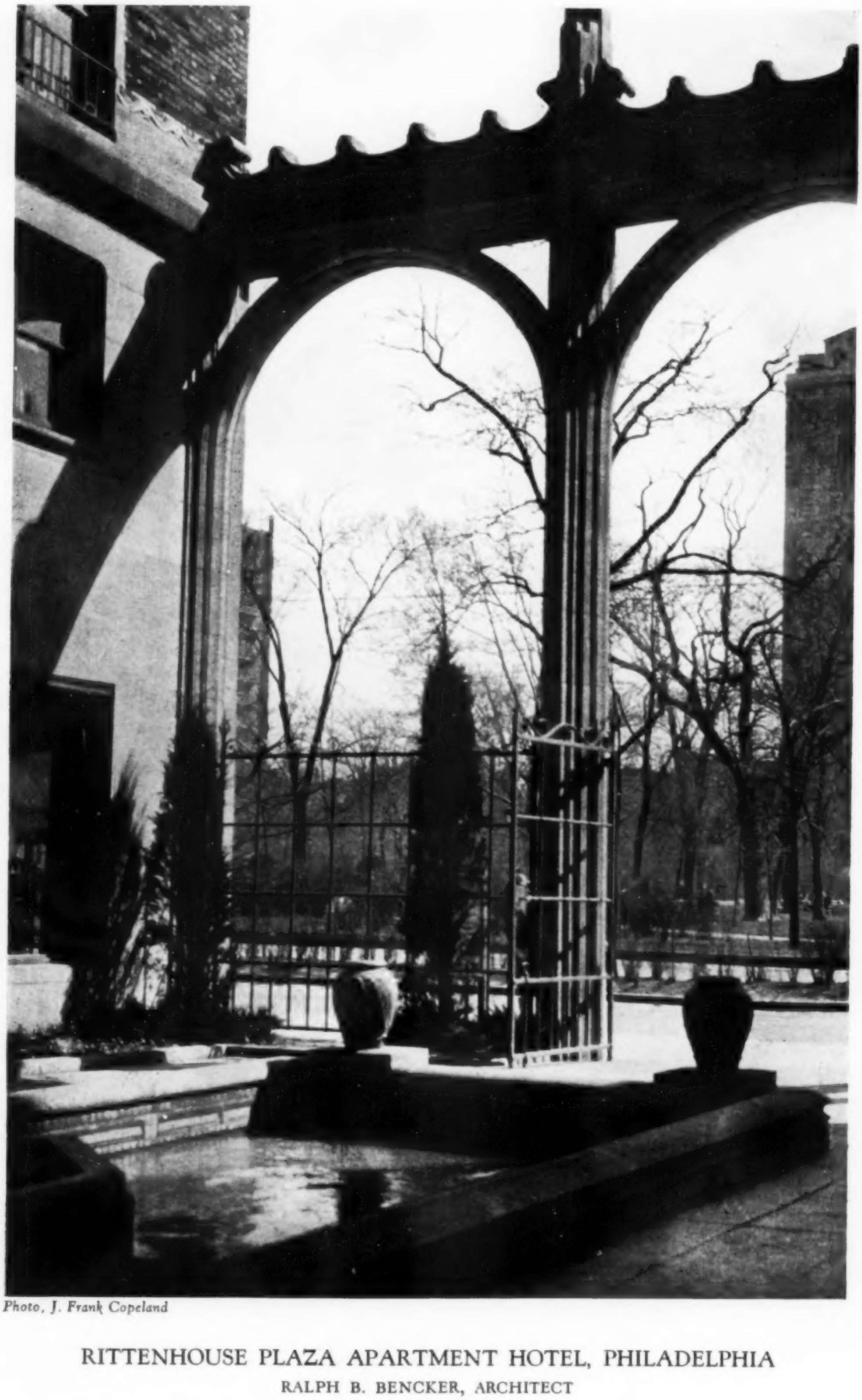
Photo, R. S. Grant

GARAGE, SUNNYSIDE GARDENS, LONG ISLAND
CLARENCE S. STEIN, ARCHITECT

Photo, R. S. Grant

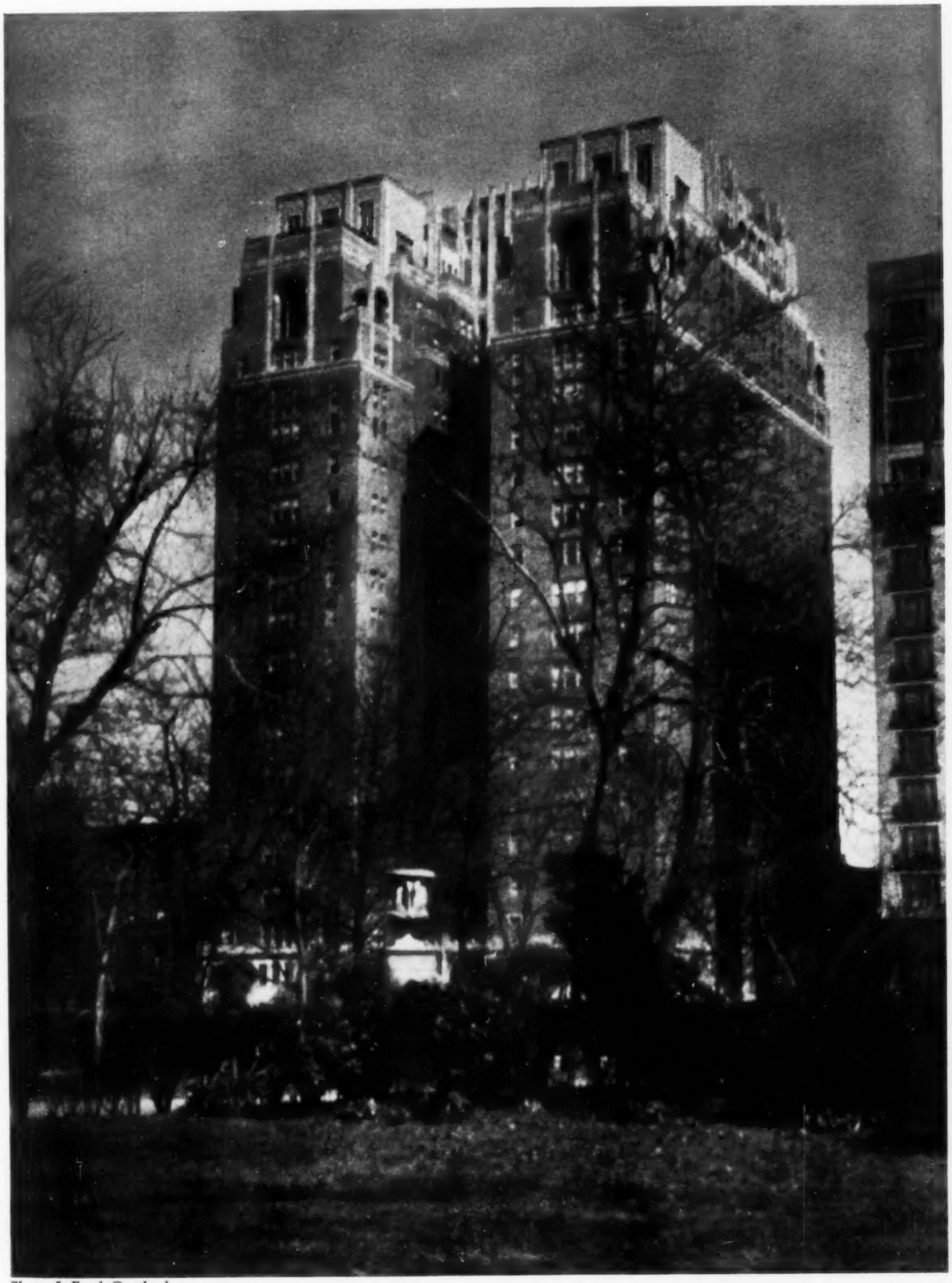
APARTMENT BUILDINGS, SUNNYSIDE GARDENS, LONG ISLAND

CLARENCE S. STEIN, ARCHITECT



Photo, J. Frank Copeland

RITTENHOUSE PLAZA APARTMENT HOTEL, PHILADELPHIA
RALPH B. BENCKER, ARCHITECT



Photo, J. Frank Copeland

RITTENHOUSE PLAZA APARTMENT HOTEL, PHILADELPHIA
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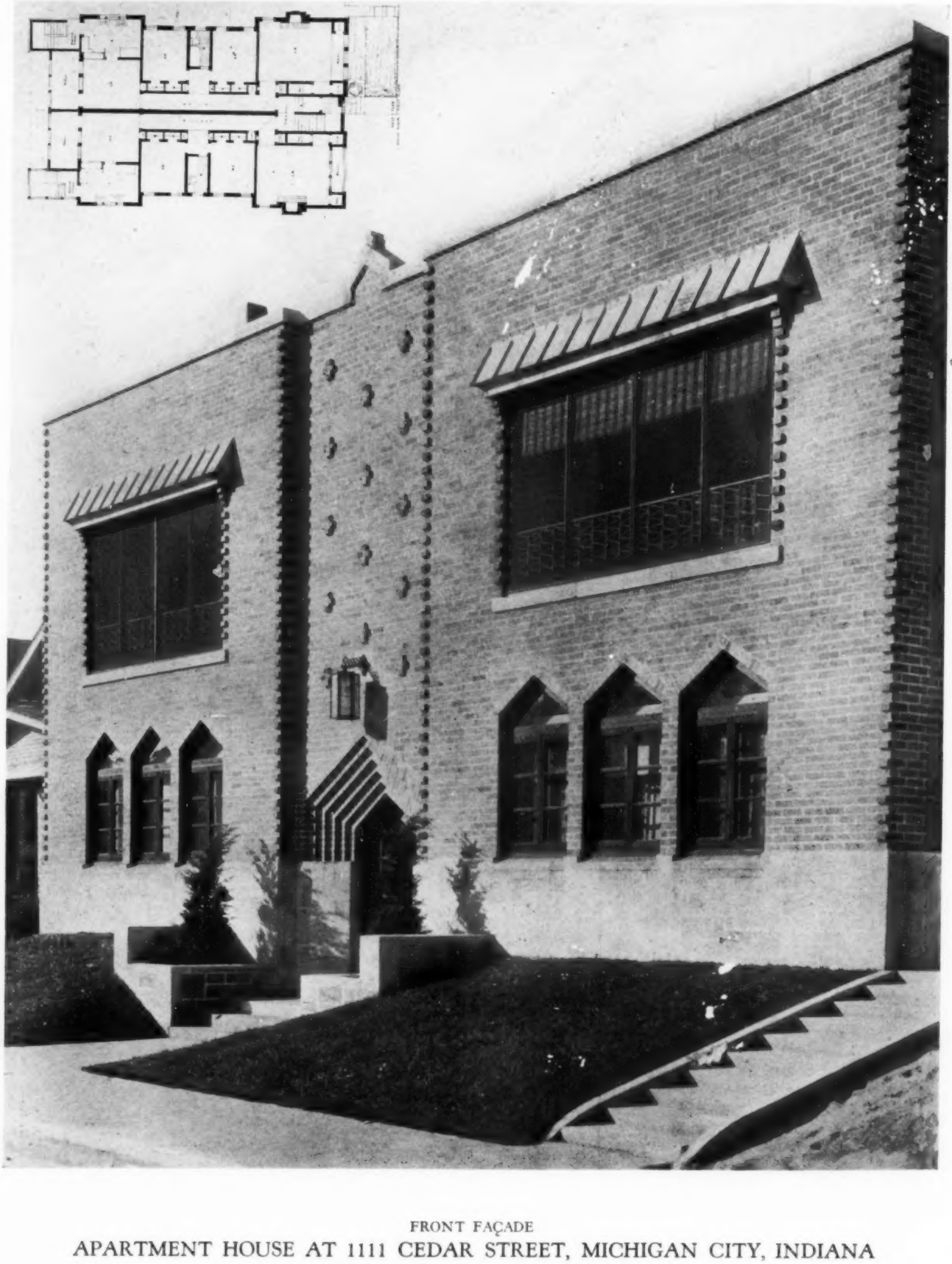
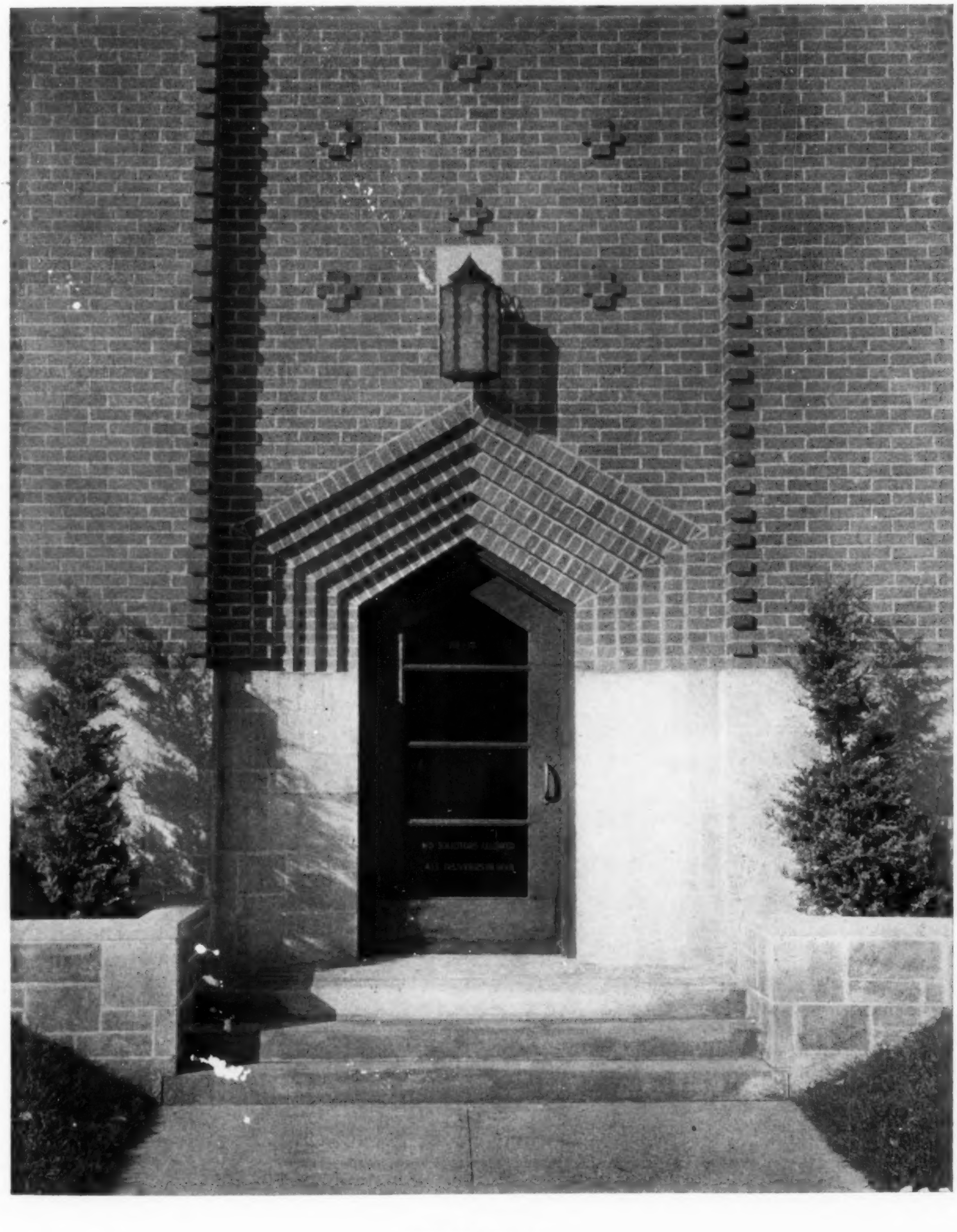


FRONT FAÇADE

APARTMENT HOUSE AT 1111 CEDAR STREET, MICHIGAN CITY, INDIANA

JOHN LLOYD WRIGHT, ARCHITECT



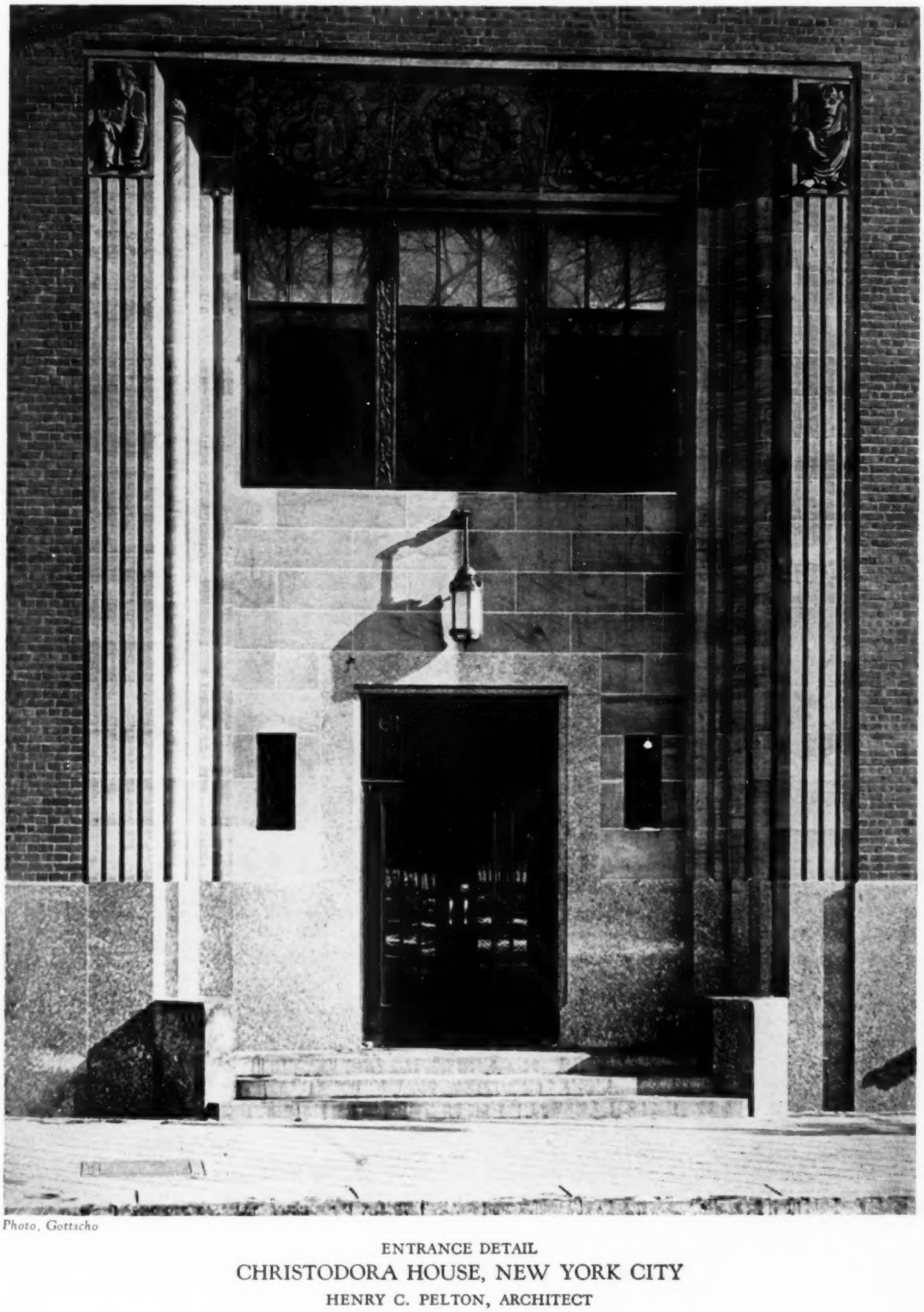
DOORWAY DETAIL
APARTMENT HOUSE AT 1111 CEDAR STREET, MICHIGAN CITY, INDIANA
JOHN LLOYD WRIGHT, ARCHITECT

Photo, Fay S. Lincoln

ENTRANCE DETAIL

APARTMENT BUILDING AT FOREST HILLS GARDENS, N. Y.

DOUGLASS FITCH, ARCHITECT



Photo, Gottscho

ENTRANCE DETAIL
CHRISTODORA HOUSE, NEW YORK CITY
HENRY C. PELTON, ARCHITECT

Photo, Gottscho

GENERAL VIEW
CHRISTODORA HOUSE, NEW YORK CITY
HENRY C. PELTON, ARCHITECT

Photo, Gottscho

LOUNGE

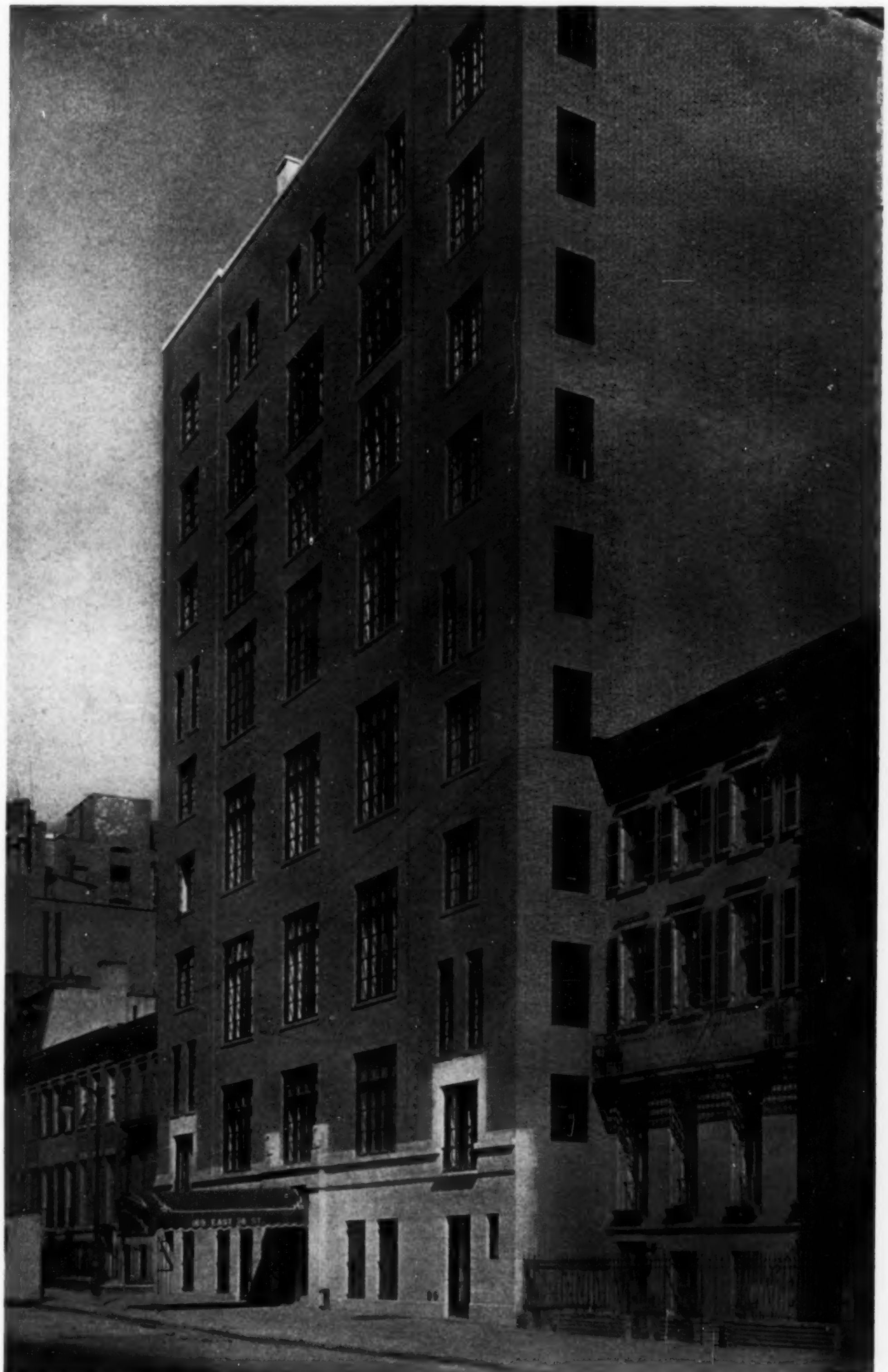
FIRST FLOOR PLAN

PLAN OF FLOORS 2, 3, 4, 5, 6, 7 and 8

CHRISTODORA HOUSE, NEW YORK CITY

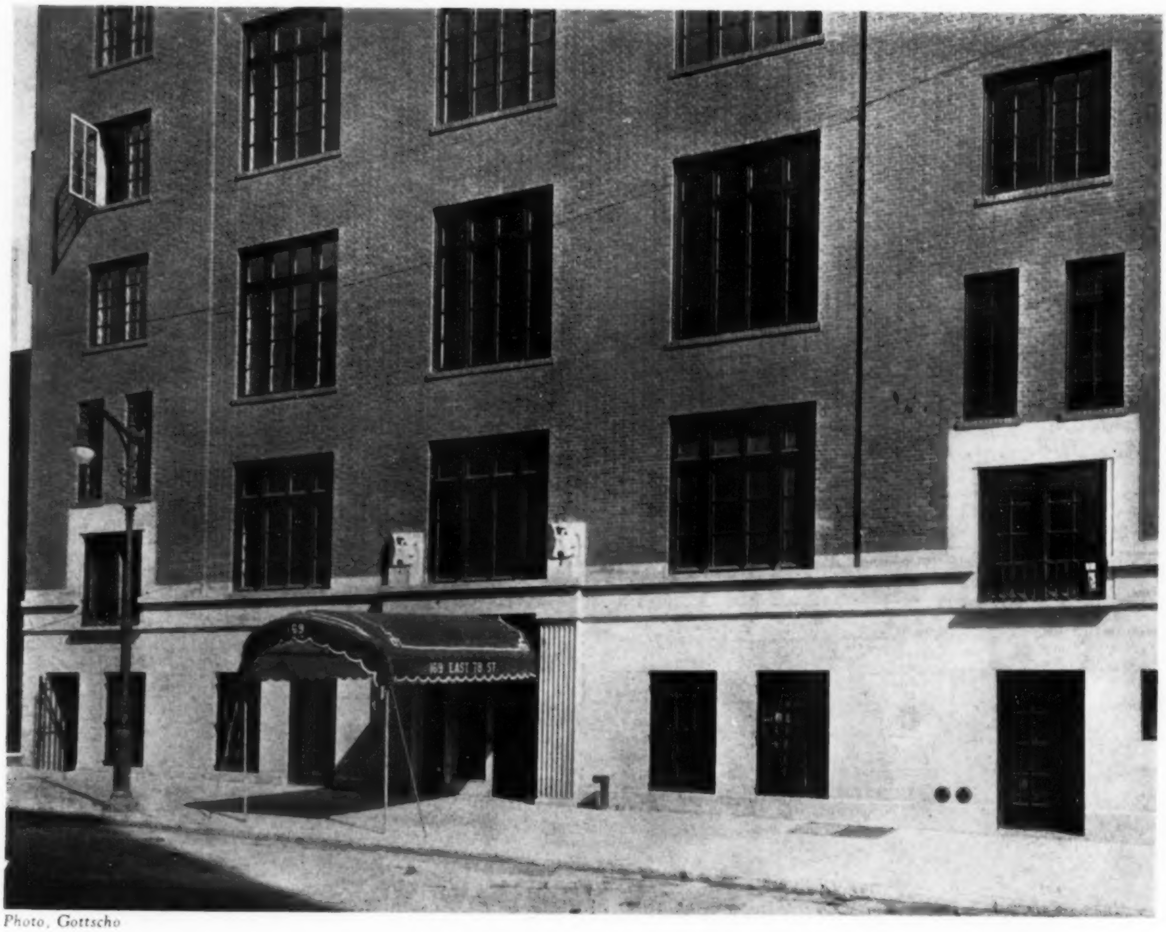
HENRY C. PELTON, ARCHITECT

PRELIMINARY DRAWING
APARTMENT BUILDING, ASTOR AND GOETHE STREETS, CHICAGO, ILL.
PHILIP B. MAHER, ARCHITECT



Photo, Gottscho

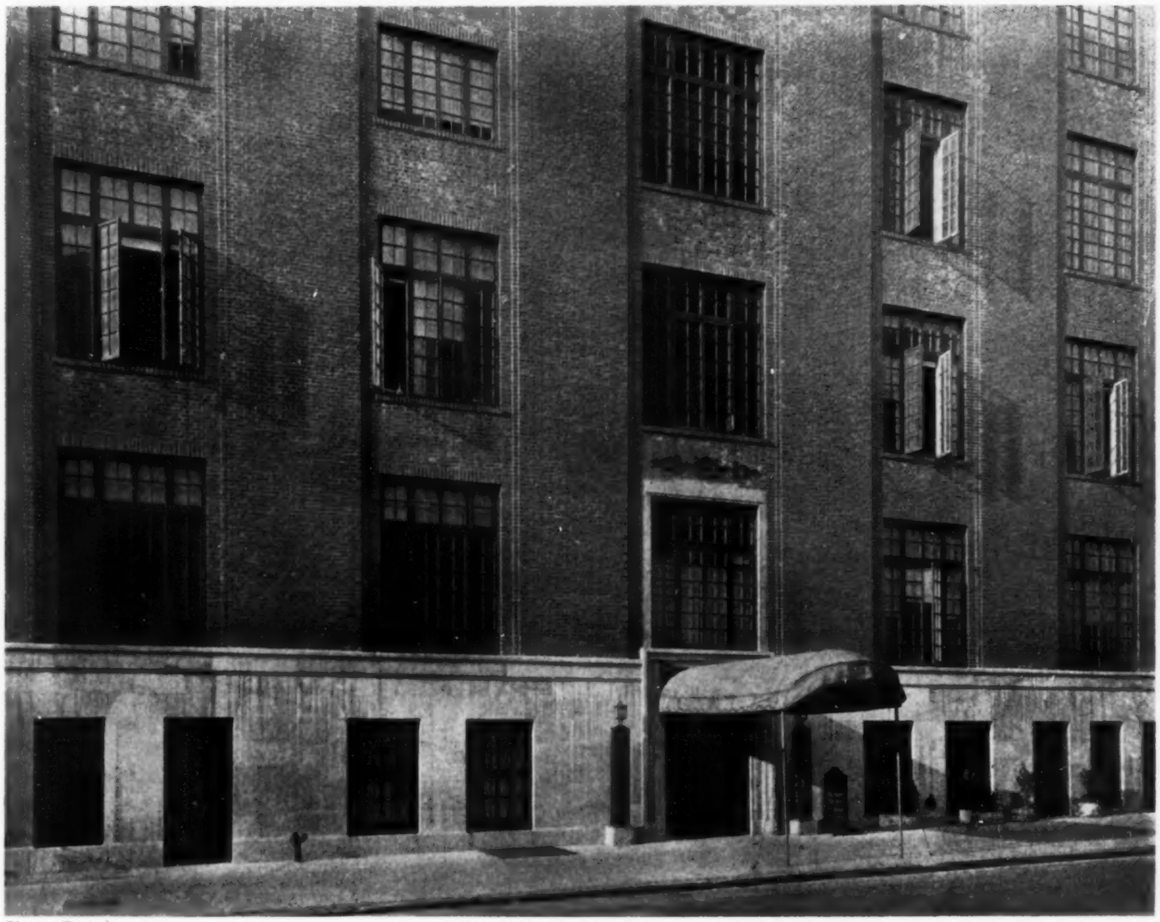
MORGAN STUDIOS, NEW YORK CITY
RODGERS & POOR, ARCHITECTS



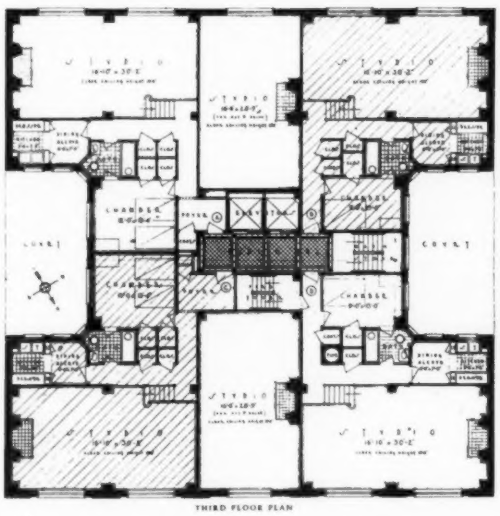
Photo, Gottscho

MORGAN STUDIOS, NEW YORK CITY

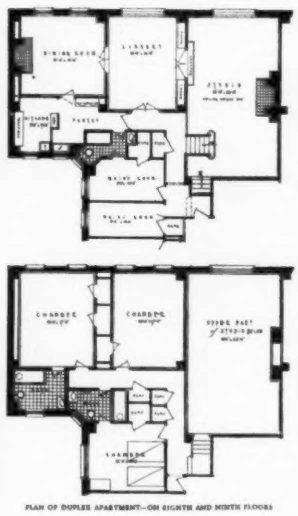
RODGERS & POOR, ARCHITECTS



Photo, Gottscho



THIRD FLOOR PLAN

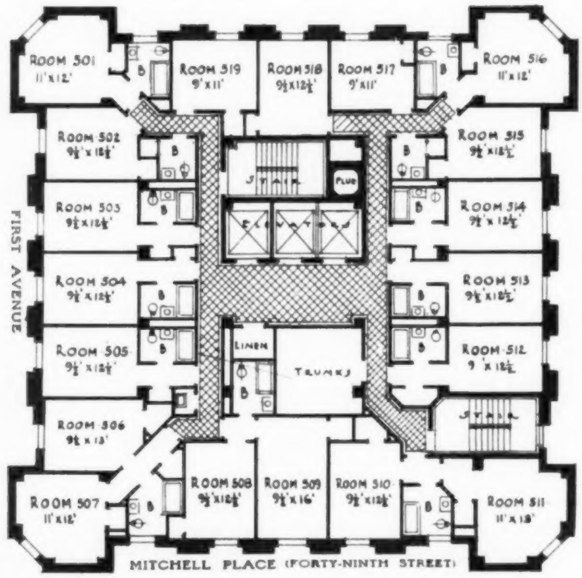


PLAN OF DUPLEX APARTMENT—ON EIGHTH AND NINTH FLOORS

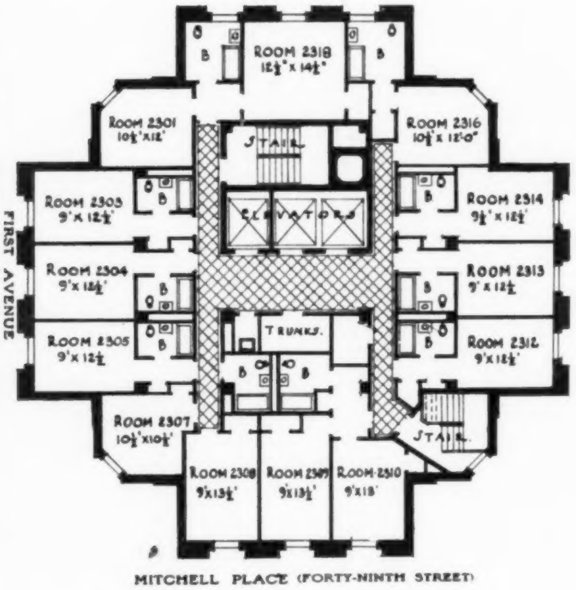
STUDIO APARTMENT BUILDING, NEW YORK CITY

RODGERS & POOR, ARCHITECTS

Photo, Peyser & Patzig



TYPICAL BEDROOM FLOOR



PLAN OF TWENTY-THIRD FLOOR

APARTMENT HOTEL AND CLUBHOUSE

THE PANHELLENIC TOWER, NEW YORK CITY

JOHN MEAD HOWELLS, ARCHITECT

Photo, Peyser & Patzig

DETAIL, EXTERIOR
THE PANHELLENIC TOWER, NEW YORK CITY
JOHN MEAD HOWELLS, ARCHITECT

Photo. Peyser & Patzig

READING ROOM
THE PANHELLENIC TOWER, NEW YORK CITY
JOHN MEAD HOWELLS, ARCHITECT

THE CLOISTERS, DORCHESTER AVENUE AT 58TH STREET, CHICAGO
GRANGER & BOLLENBACHER, ARCHITECTS

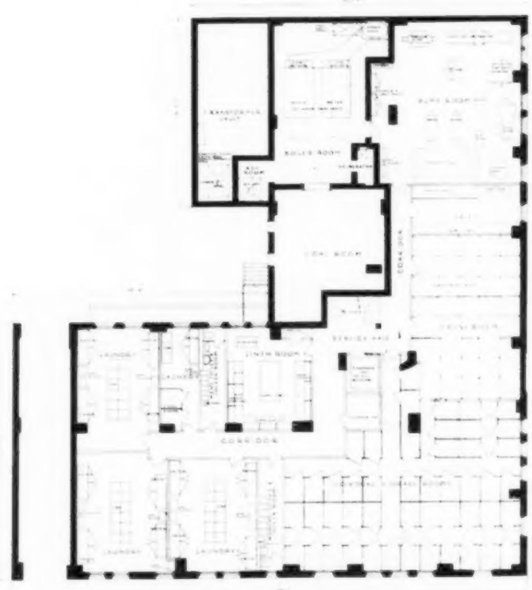
EAST ELEVATION

FIRST FLOOR PLAN

APARTMENT HOUSE FOR OFFICERS
MILITARY ACADEMY, WEST POINT, N. Y.
CRAM & FERGUSON, ARCHITECTS

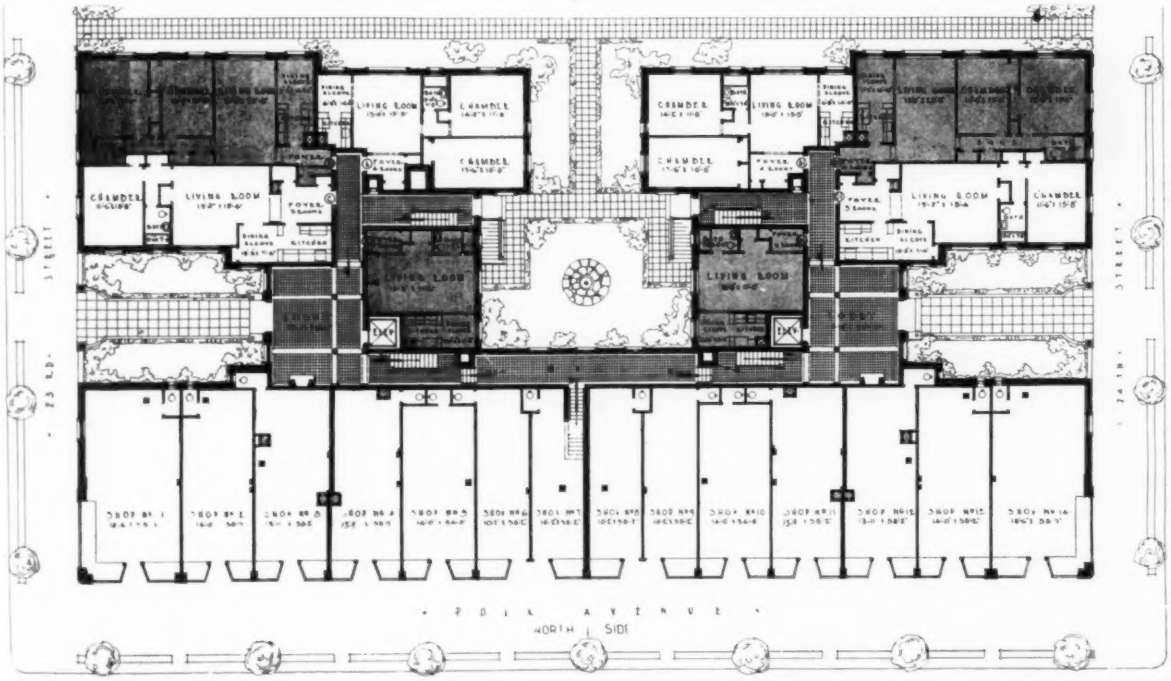
TYPICAL FLOOR PLAN

THE CLOISTERS, CHICAGO
GRANGER & BOLLENBACHER, ARCHITECTS



BASEMENT PLAN

EDGEWATER CHATEAU APARTMENTS, CHICAGO
RISSMAN & HIRSCHFELD, ARCHITECTS

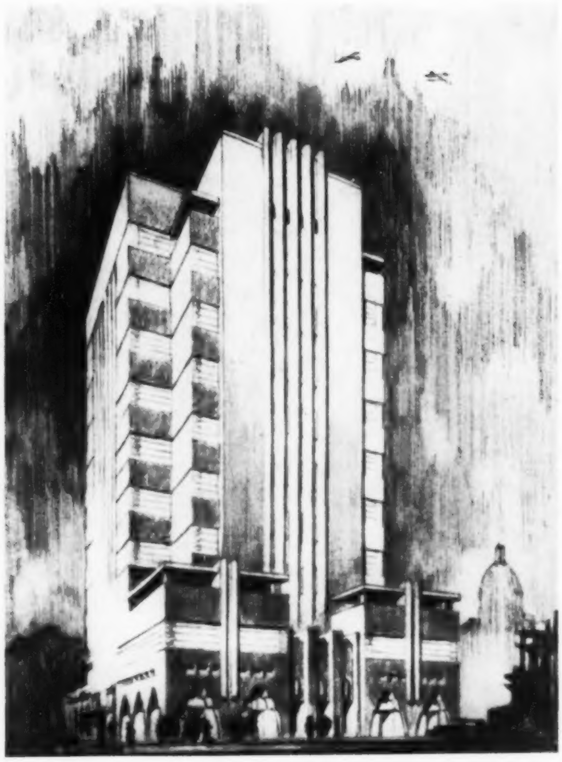


One of the recent Apartment Buildings erected by the Queensboro Corporation and the Jackson Heights Apartment Corporation, New York

RAVENNA COURT, JACKSON HEIGHTS, NEW YORK

ROGERS & HANEMAN, ARCHITECTS

PRELIMINARY DRAWING
RIVERSIDE APARTMENTS, EVANSVILLE, IND.
BOWLING & SHANK, ARCHITECTS



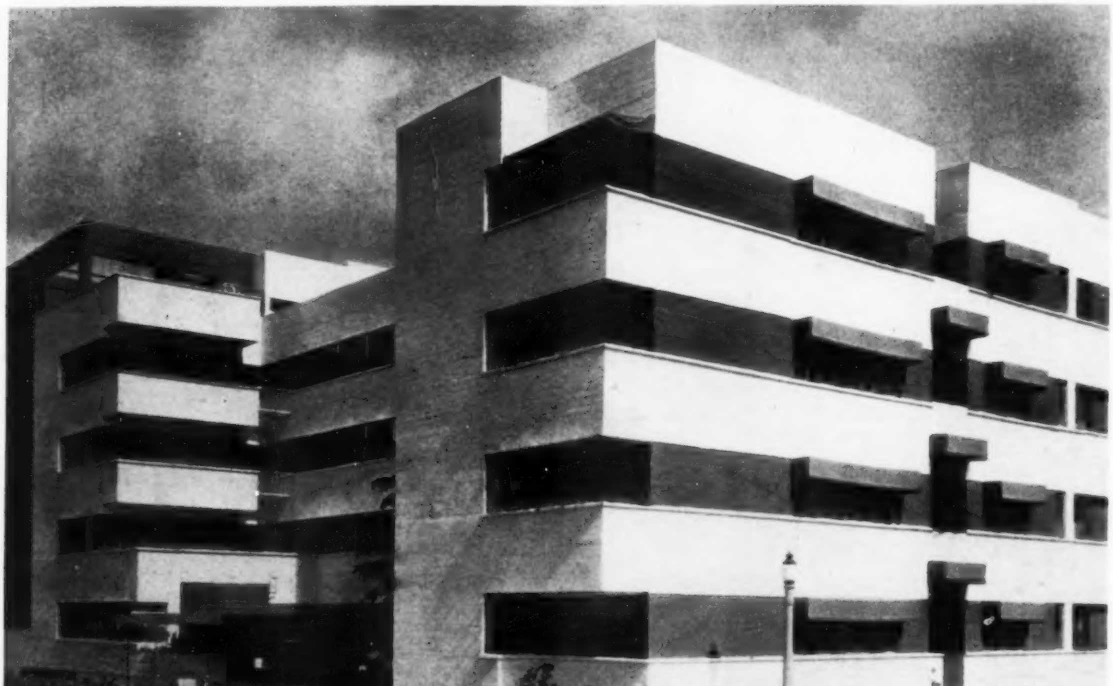
PRELIMINARY DRAWING
VIRGINIA APARTMENTS, TOPEKA, KANSAS
BOWLING & SHANK, ARCHITECTS

TYPICAL FLOOR PLAN
VIRGINIA APARTMENTS, TOPEKA, KANSAS
BOWLING & SHANK, ARCHITECTS

GARDEN VIEW AND FLOOR PLAN

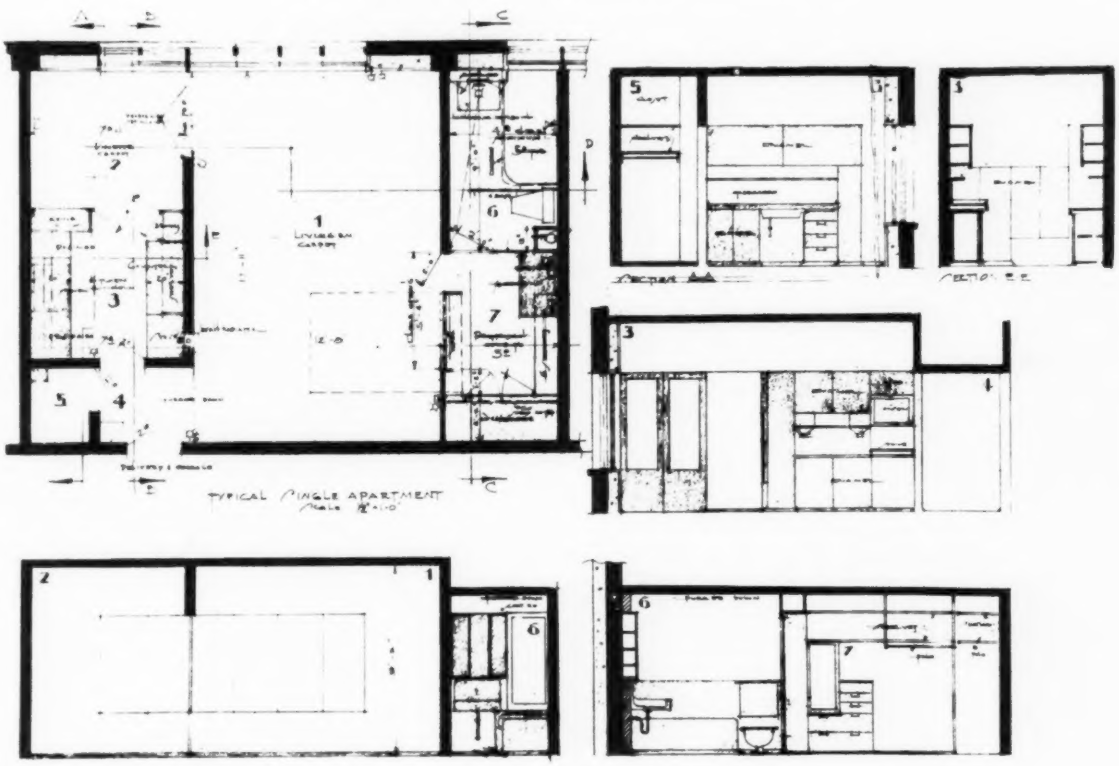
TILDEN GARDENS, WASHINGTON, D. C.

PARKS & BAXTER, ARCHITECTS

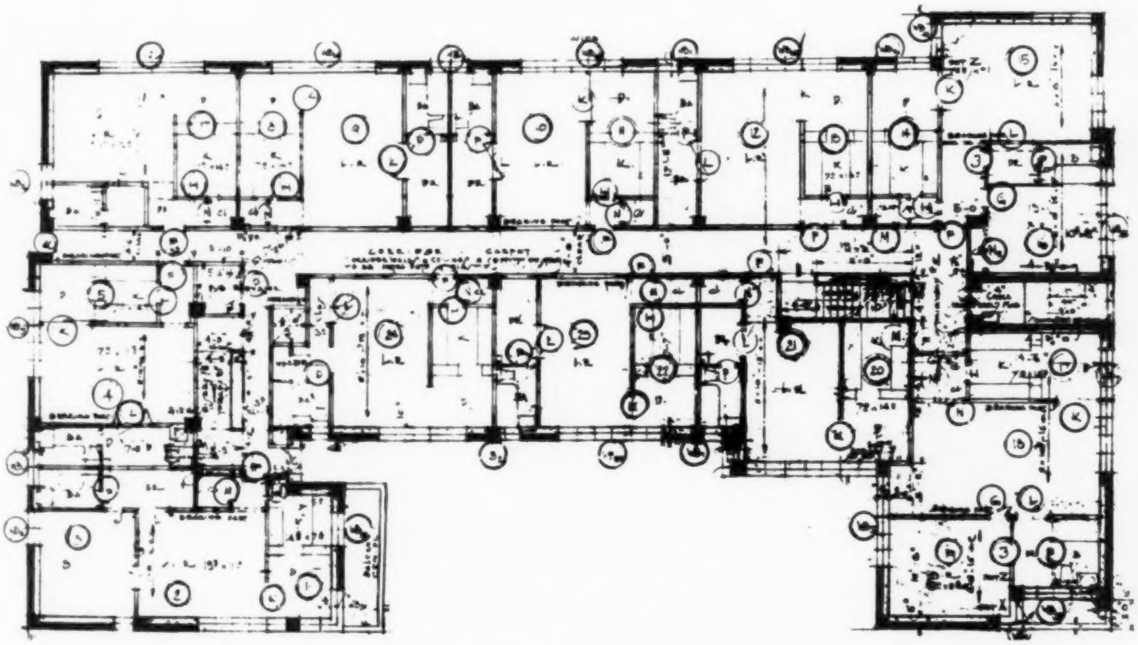


Photo, W. D. Morgan

GARDEN APARTMENT BUILDING, LOS ANGELES
RICHARD J. NEUTRA, ARCHITECT



DETAIL PLAN AND ELEVATIONS OF TYPICAL SINGLE APARTMENT



TYPICAL FLOOR PLAN

North front broken around a garden court to achieve west and east exposures of north apartments

GARDEN APARTMENT BUILDING, LOS ANGELES

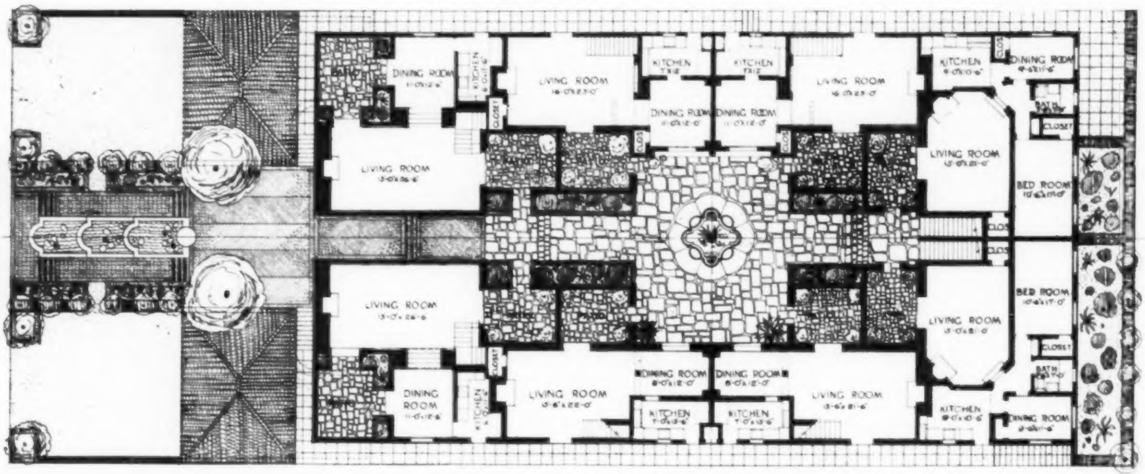
RICHARD J. NEUTRA, ARCHITECT

Photo, Margaret Craig

A CORNER OF THE COURT
APARTMENT HOUSE IN LOS ANGELES
PIERPONT AND WALTER S. DAVIS, ARCHITECTS

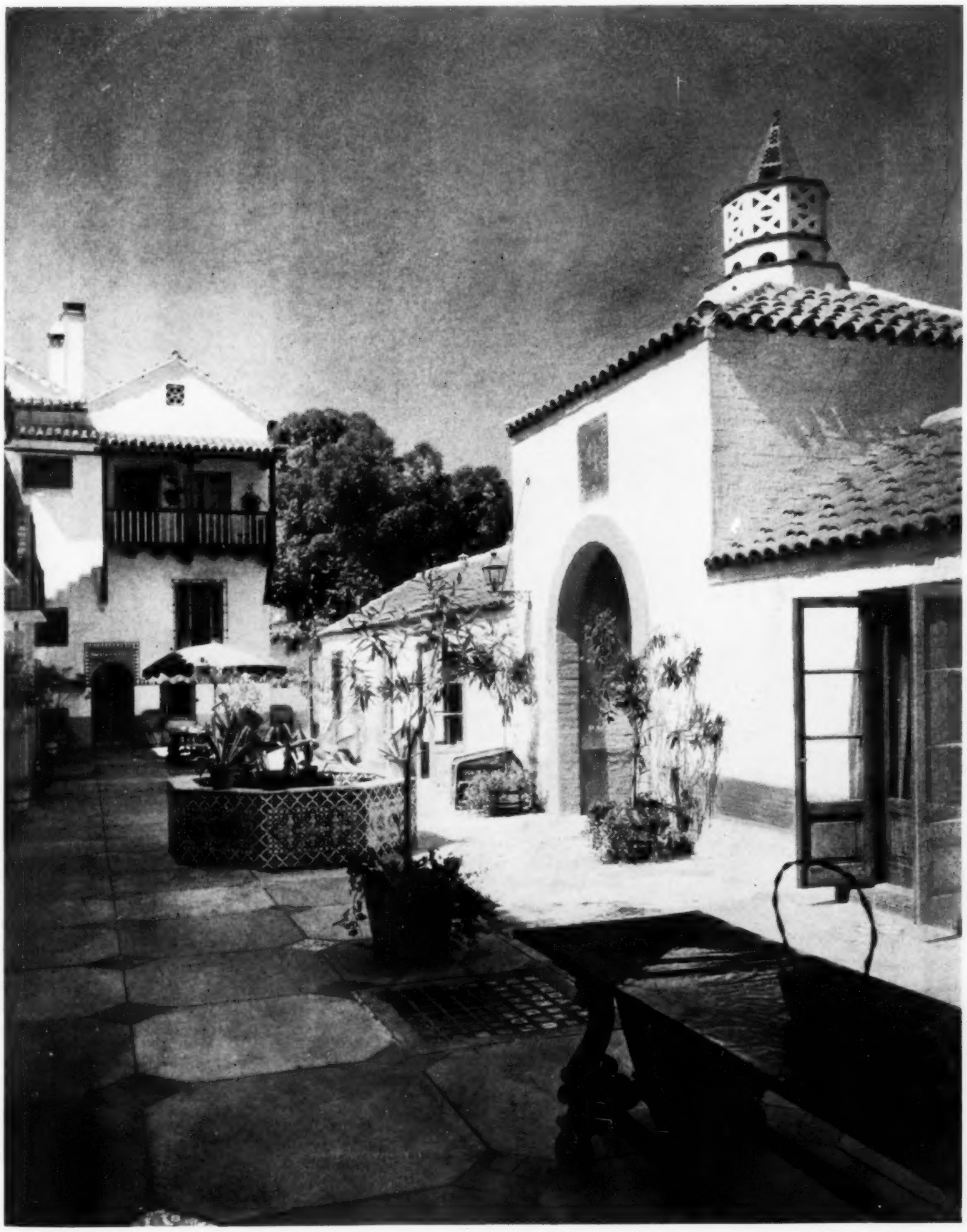
Photo, Margaret Craig

ENTRANCE ARCH, APARTMENT HOUSE IN LOS ANGELES
PIERPONT AND WALTER S. DAVIS, ARCHITECTS



PLAN OF APARTMENT HOUSE, LOS ANGELES
PIERPONT AND WALTER S. DAVIS, ARCHITECTS

APARTMENT BUILDING IN HOLLYWOOD, CAL.
ARTHUR B. ZWEBELL, DESIGNER



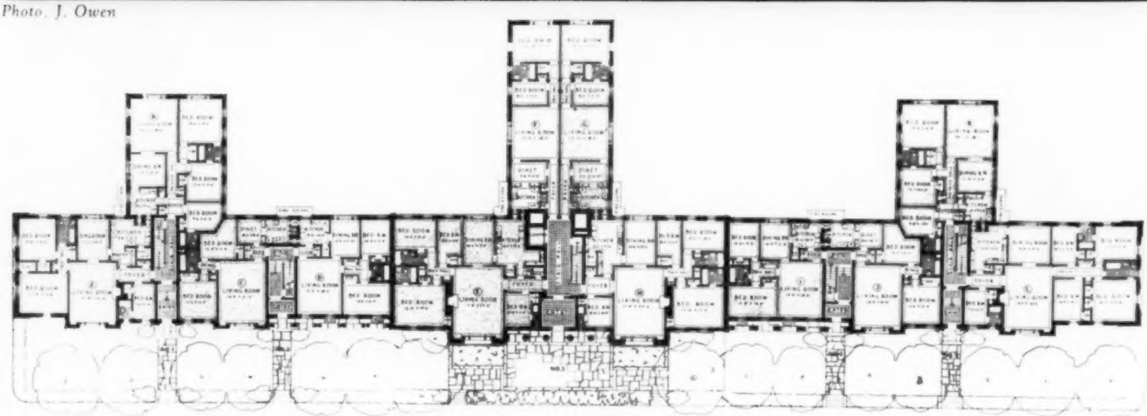
APARTMENT BUILDING IN HOLLYWOOD, CALIFORNIA
ARTHUR B. ZWEBELL, DESIGNER

APARTMENT BUILDING IN HOLLYWOOD, CALIFORNIA
ARTHUR B. ZWEBELL, DESIGNER

ENTRANCE, THE WHITEHALL APARTMENTS, CHICAGO

KLABER & GRUNSFELD, ARCHITECTS

Photo. J. Owen

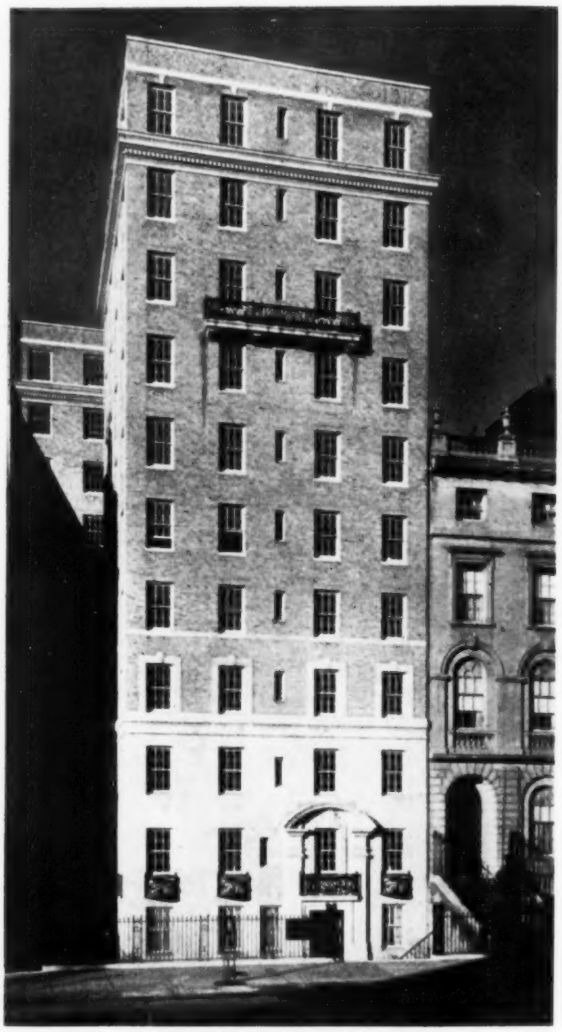


THE COLONNADE APARTMENT, BRONXVILLE, N. Y.
PENROSE V. STOUT, ARCHITECT

Photo, Gottscho

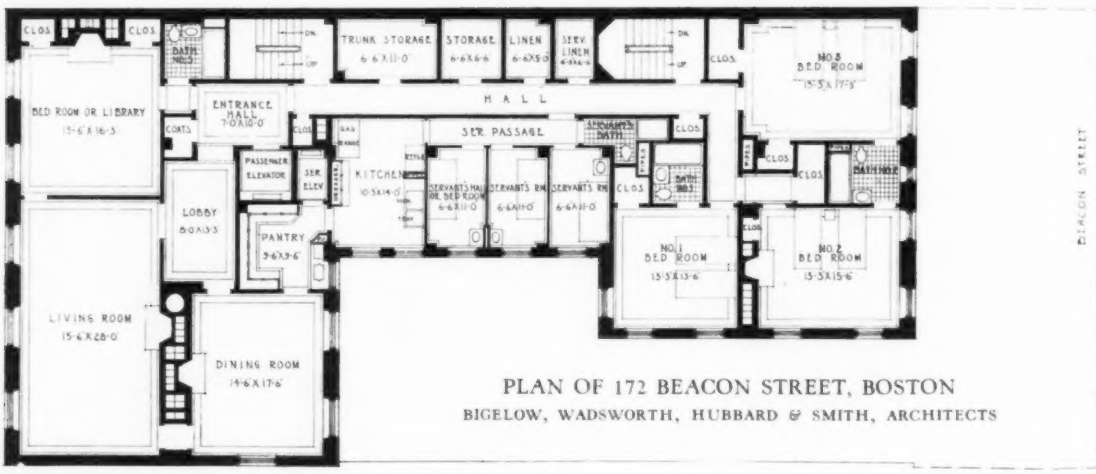
KELVIN APARTMENTS, FOREST HILLS, LONG ISLAND

T. ENGLEHARDT, ARCHITECT



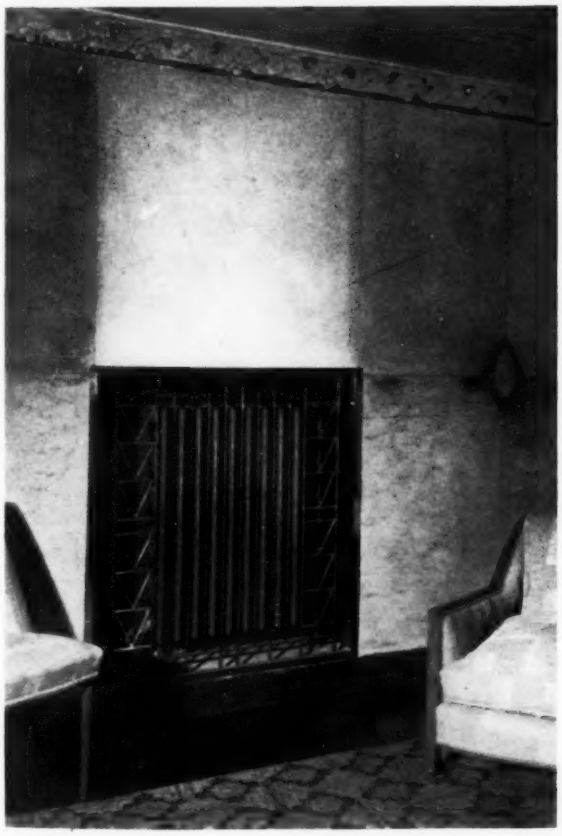
192 COMMONWEALTH AVENUE, BOSTON 172 BEACON STREET, BOSTON

BIGELOW, WADSWORTH, HUBBARD & SMITH, ARCHITECTS



PLAN OF 172 BEACON STREET, BOSTON

BIGELOW, WADSWORTH, HUBBARD & SMITH, ARCHITECTS



FLOOR PLAN AND DETAILS OF LOUNGE

APARTMENT HOUSE, 3 EAST EIGHTY-FOURTH STREET, NEW YORK

JOHN M. HOWELLS AND RAYMOND M. HOOD, ARCHITECTS

Photo, Gillies

APARTMENT HOUSE, 3 EAST EIGHTY-FOURTH STREET, NEW YORK
JOHN M. HOWELLS AND RAYMOND M. HOOD, ARCHITECTS

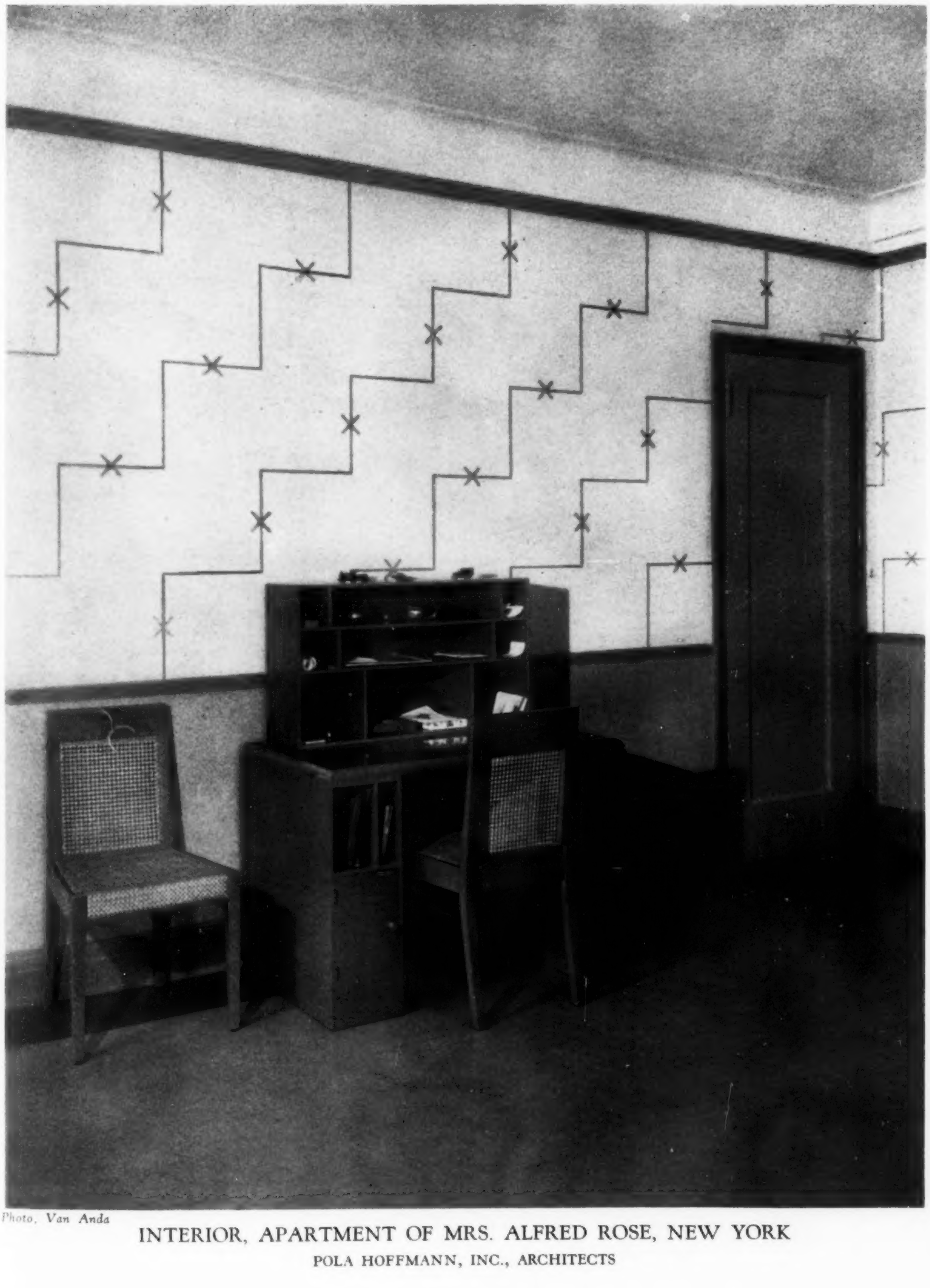
ALLIED ARTS
AND
CRAFTSMANSHIP

Photo, J. Frank Copeland

FOUNTAIN IN COURT
RITTENHOUSE PLAZA APARTMENT HOTEL, PHILADELPHIA
RALPH B. BENCKER, ARCHITECT

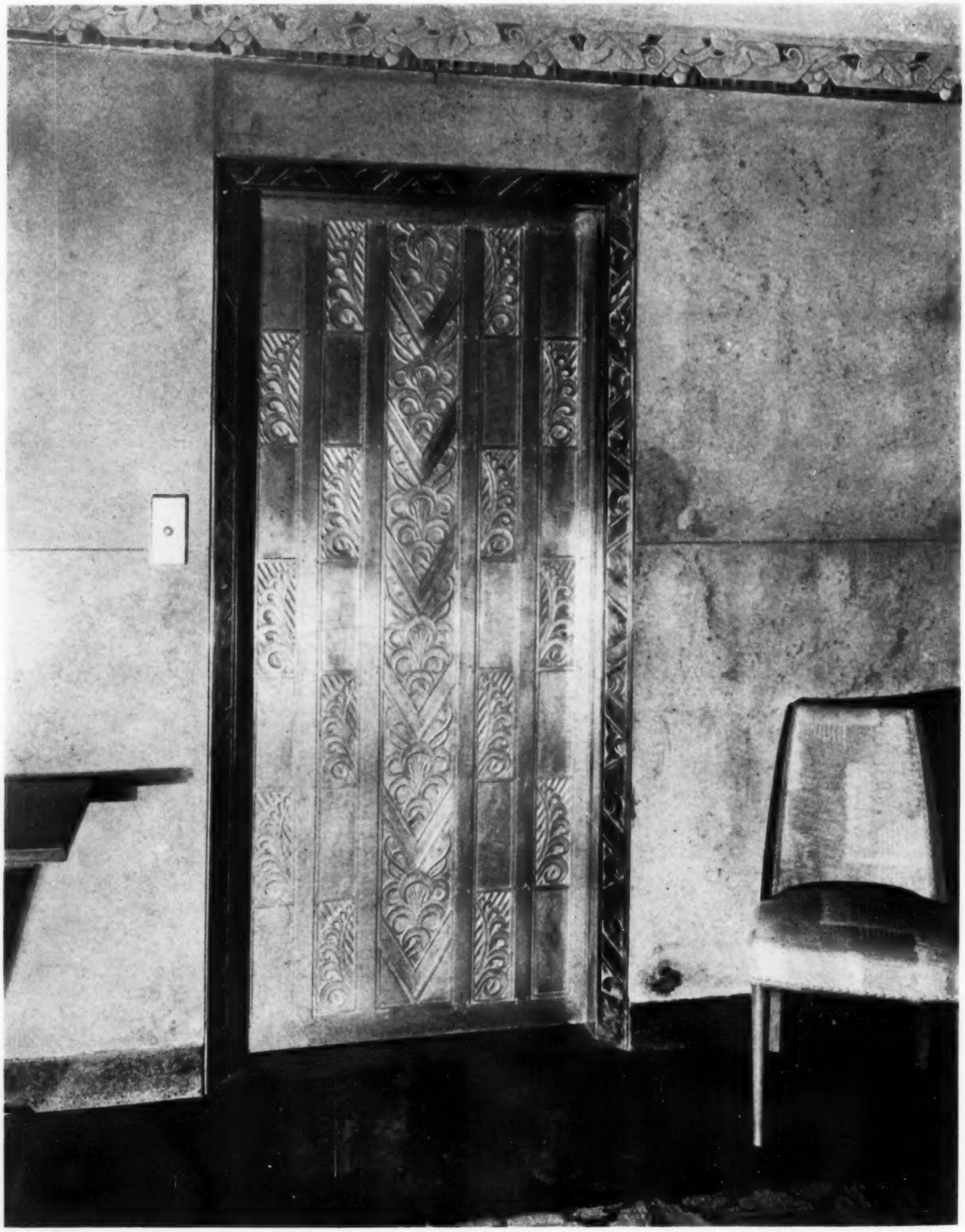
Photo, Van Anda

INTERIOR, APARTMENT OF C. J. LIEBMAN, ESQ., NEW YORK
POLA HOFFMANN, INC., ARCHITECTS



Photo, Van Anda

INTERIOR, APARTMENT OF MRS. ALFRED ROSE, NEW YORK
POLA HOFFMANN, INC., ARCHITECTS

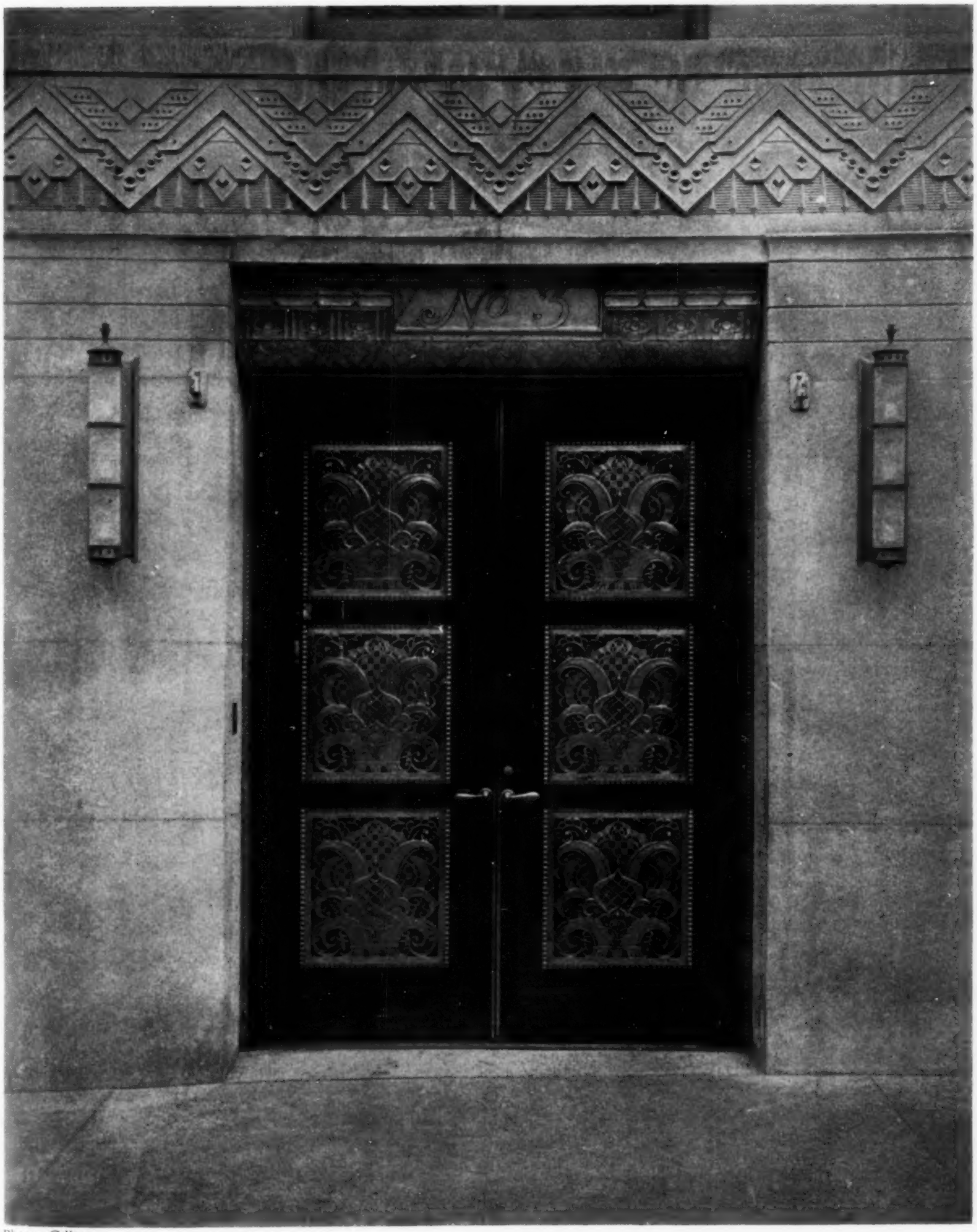


Photo, Gillies

ELEVATOR DOOR

APARTMENT HOUSE, 3 EAST EIGHTY-FOURTH STREET, NEW YORK

JOHN M. HOWELLS AND RAYMOND M. HOOD, ARCHITECTS



Photo, Gillies

ENTRANCE DOORWAY
APARTMENT HOUSE, 3 EAST EIGHTY-FOURTH STREET, NEW YORK
JOHN M. HOWELLS AND RAYMOND M. HOOD, ARCHITECTS

Photo, Gillies

BRONZE PANEL OF DOOR
APARTMENT HOUSE, 3 EAST EIGHTY-FOURTH STREET, NEW YORK
JOHN M. HOWELLS AND RAYMOND M. HOOD, ARCHITECTS

TECHNICAL NEWS
AND
RESEARCH

Photo. W. D. Morgan

CASEMENT WINDOWS
GARDEN APARTMENT BUILDING, LOS ANGELES
RICHARD J. NEUTRA, ARCHITECT

Featuring

SOUND PROOFING APARTMENTS

Efficiency in Apartment House Planning
Space-saving Apartment Equipment

SOUND PROOFING APARTMENTS

BY ROBERT L. DAVISON *

TECHNICALLY speaking, the subject of Architectural Acoustics includes (1) the consideration and correction of sound within rooms where sound originates and (2) the prevention of transmission of sound through floors and walls of buildings. However, it has become the general practice to limit the term "acoustics" to the science of sound within a room and to refer to the prevention of sound transmission through floors and walls as "sound deadening," or "sound insulation." The term "sound insulation" should always be used as "sound deadening" and is often accepted as synonymous with "sound absorption."

ACOUSTICAL TREATMENT

While various factors are involved in acoustics of an auditorium, only reverberation and loudness need be considered in apartment house design. They can be controlled in part in various ways. Draperies, carpets and furniture are all effective in proportion to their absorbing power. (See adjacent table.) Carpets in foyers and halls are especially desirable for their absorption value and lessening of impact. Where, for sanitary or cost reasons, they are not used, sound absorption may be obtained through use of one of the many "acoustical materials". Provision should be made, of course, for sound prevention and sound absorption in kitchens or dining rooms when restaurant service is provided and in other parts of the building where noise may originate.

SOUND INSULATION

Sound insulation is of greater importance in apartment buildings than acoustical correction. It ranks in importance with provision for light and air, and represents a problem which must be solved but about which almost nothing is known today.

In this increasingly noisy life of ours with radio and jazz parties and *sometimes* children, quiet is going to take on a greatly enhanced *commercial* importance. The architect will give as much consideration to the quiet-producing qualities of materials for buildings as he now gives to their aesthetic appeal. The significance of this problem is evidenced in the following letter to The Architectural Record from the owner of a large apartment house:

"In order that you may form a mental picture of our situation, imagine an apartment building of monolithic concrete construction of the highest kind with the finest type of equipment and appointments, the apartments laid out in the so-called efficiency form. We were fortunate in having the services of a construction engineer who reduced the weight of the concrete mass and structural members to the lowest possible point consistent with safety and good engineering practice. This naturally reduced the amount of inertia but increased the vibration. The result was a very acute sound transmission problem and its serious form was not realized until the building was finished and occupied. It was then that we discovered how acute this condition was, particularly between apartments and through the pipe chases.

SOUND ABSORBING COEFFICIENTS FOR PITCH 512

Material	Coefficient per sq. ft.
Open window as basis for comparison	1.00
Akoustolith (artificial stone)	0.36
Ambler sound absorbing plaster	0.14
Balsam Wool, bare, 1 in. thick, 0.26 lb., per sq. ft	0.44
Brick wall	0.032
Brick wall, painted	0.017
Brick, set in cement	0.025
Calacoustic plaster	0.16
Carpet, unlined	0.15
Carpet, lined	0.20
Carpet, with ½ in. *Ozite* hairfelt	0.25
Carpet rugs	0.20
Acousti-Celotex, type A, unpainted	0.25
Acousti-Celotex, type B, painted or unpainted	0.47
Acousti-Celotex, type BB, painted or unpainted	0.70
Acousti-Celotex, type C, painted or unpainted	0.30
Armstrong Cork Board, 1 in. thick, 0.875 lb. per sq. ft	0.30
Armstrong Cork Board, sprayed with cold water paint	0.30
Armstrong Cork Board, 2 in. thick, 1.6 lb. per sq. ft.	0.35
Cork tile	0.03
Curtains in heavy folds	0.40-0.75
Fibroblock, unpainted	0.42
Flaxlinum, bare, 1 in. thick	0.61
Flaxlinum, 1 in. thick, with unpainted membrane	0.11
Gimco Rock Wool, bare	0.57
Glass, (single thickness)	0.027
Hairfelt, bare, 1 in. thick, 0.75 lb. per sq. ft.	0.58
Linoleum	0.03
Marble	0.01
Nashkote, A, ½ in. thick	0.31
Nashkote, A, ¾ in. thick	0.41
Nashkote, B, ½ in. thick	0.37
Plaster on wood lath	0.034
Plaster on metal lath	0.033
Plaster on tile	0.025
Sabinite acoustical plaster	0.21
Stage opening, depending on stage furnishings	0.25-0.40
Ventilators	0.75
Wood, plain	0.06
Wood, varnished	0.03
Acoustic Zenitherm (cork granules cemented with plaster 1.14 in. thick, 2.07 lb. per sq. ft.)	0.33
Adult person	4.7
Plain wood seats	0.15
Church pews, per seats	0.2-0.5
Seats, upholstered seat and back	0.75-2.00
Seat cushions, per seat	1.00-2.00

(Watson, Floyd R., *The Absorption of Sound Materials*. Table 6, Page 26 of Bulletin No. 172, University of Illinois.)

*Acknowledgment is made of valuable assistance from Clifford M. Swan, consultant acoustical engineer; from E. E. Free, consulting engineer; from Harvey Fletcher of Bell Telephone Laboratories and from the reference books listed at the end of this article.

"Experiments were made to reduce the sound transmission through partition walls but without very good results until we applied a [well-known acoustical company's] treatment which effectively reduced the annoying transmission through partition walls and across pipe chases. However, the annoyance caused by the transmission through the floor slabs has been accentuated and it appears that we cannot hope for relief unless we treat the ceiling in the same manner as the walls.

"It is quite evident that the time to apply sound transmission treatment is on the drafting table before the building is in construction, for no matter what is done after the building is completed it is bound to be more or less of a makeshift and exceedingly costly and annoying.

"Coming now to your specific questions, there is no difference in the yearly rent before and after sound insulation, because it was simply impossible to retain tenants under previous conditions and, on the other hand, we could charge no higher rents than originally scheduled.

"As to the difference in turnover, of course there has been a decided improvement because of the insulation treatment.

"Any attempt on our part to apply the cost to a room or square yard basis would be misleading because the price included very extensive treatment in the pipe chases."

The difficulty of this problem is further apparent when one bears in mind that an electric conduit or steam pipe connected to a partition may transmit sound in the same manner that sound from a phonograph record is transmitted by a needle and made audible by the diaphragm and reproducer. While

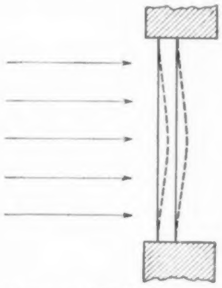
Medium	Velocity of Sound
Air	1,088 ft. per sec.
Water . . .	4,728 ft. per sec.
Pine Wood,	10,900 ft. per sec.
Brick . . .	11,980 ft. per sec.
Steel	16,360 ft. per sec.

Acoustics of Buildings—Watson

VELOCITY OF SOUND IN VARIOUS MEDIA

some general principles for sound prevention treatment may be given, the subject is so complicated that if a maximum of sound deadening is desired, it will be advisable to consult an acoustical expert or a company installing a guaranteed sound insulation system.

It is natural to think of sound deadening in terms of heat insulation, but the two problems are vastly different. The insulation of sound is not a problem of material so much as it is a problem of construction. There is no royal road or textbook rule for sound proof design. Sound proof construction methods have not been developed to a point where definite formulae or simple rules are possible, as in heat insulation.



Acoustics of Buildings—Watson

HOW A PARTITION IS BULGED BY PRESSURE OF SOUND

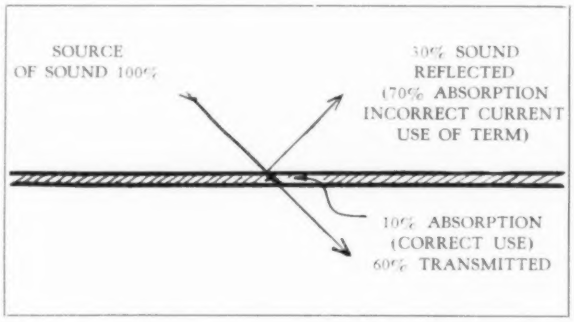
I. Principles of Sound Transmission. Sound is transmitted by molecular vibration and the structural vibration of the partition (or floor) which acts like a thick elastic plate or drum head. Some idea of this pressure may be gathered from the fact that a normal speaking voice will deflect a 2" x 4" stud, lath and plaster partition 1/100 of an inch.

A part of the sound waves striking a surface are reflected and part are transmitted by molecular vibration or diaphragm action to space beyond. A certain amount is absorbed by friction in the wall. (See sketch below.)

Considerable confusion arises from the dual use of the term "absorption."

In Acoustical Correction percentage of absorption means percentage of sound not reflected.

In Sound Transmission, percentage of absorption means percentage absorbed by wall during transmission. (See sketch below.)

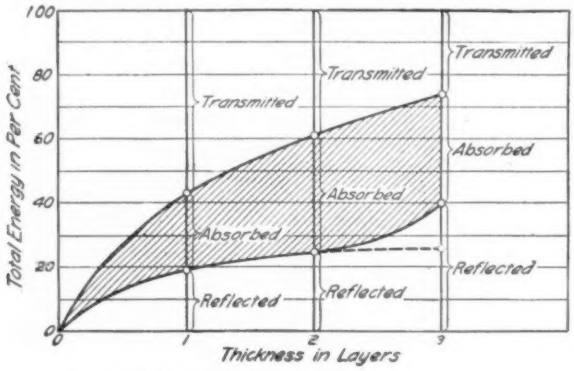


DUAL USE OF TERM "ABSORPTION"

These uses are not synonymous. For example: an open doorway has 100% sound absorption (non-reflection) value, speaking acoustically and 0% sound absorption speaking from the standpoint of sound insulation.

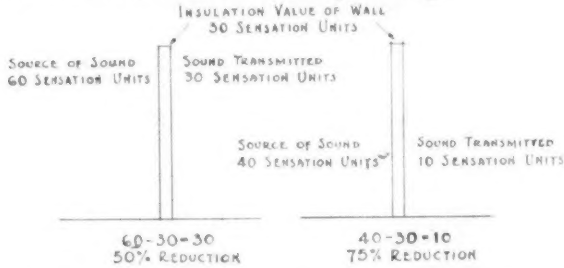
If sound absorption materials are hung in a doorway it will be found that as their percentage of sound absorption increases (speaking acoustically) their sound insulating value decreases. But certain of these sound absorption materials (speaking acoustically) do absorb (speaking from standpoint of sound transmission) a percentage of sound in process of transmission and to this extent they are

of value. Watson's graph indicates this principle.*



Acoustics of Buildings—Watson
RELATIVE AMOUNTS OF SOUND REFLECTED, ABSORBED, AND TRANSMITTED BY HAIRFELT

Percentage figures on sound insulation are often given but are fundamentally unreliable and are a source of confusion. Loudness reductions as caused by absorption or by reflection are all subtractive and are not percentage propositions. We cannot represent loudness reduction in either case by percentage figures without knowing the loudness of the sound considered. The following sketch is an illustration of the incorrect use of percentage.



II. Sound Transmission Measurement. The term "Sensation Units" **(See footnote, page 293) is self-explanatory. It is approximately the smallest *change* in loudness level of sound it is possible for the ear to detect. For many purposes it is convenient to use for standards of comparison the "Threshold of Hearing" as a base from which measurements are made. The level of any sound expressed in units above this sound is called the "Sensation Level." There are about 135 Sensation Units between the "threshold of hearing" and the "threshold of feeling"—the maximum sensation of loudness which the ear can register. The "sensation of loudness" does not increase in proportion to physical intensity of sound, as shown in the table below.

* "Porous materials such as generally used for acoustical treatment transmit considerable sound and reflect little, while paper-lined hair felt and quilt transmit less and reflect more," but there is almost no data on the actual sound absorption values of these materials.

AMOUNT OF SOUND INSULATION REQUIRED*
Sensation Units of probable sound *less* Sensation Units of desired sound level = Sensation Units of Insulation

LOUDNESS IN TERMS OF

Maximum Distance at Which Called Numbers May Be Recognized				Sound Level	Sensation Level "Sensation Units"†	Physical Intensity Ratio
Average Whisper	Loud Whisper pp Voice	mf Voice	ff Voice			
				Threshold of Feeling	130	10,000,000,000,000
				High Pitch Loud Whistle	120	1,000,000,000,000
			0.8"	Gunfire	110	100,000,000,000
			2.7"		100	10,000,000,000
		1.5"	8.5"	Noise in Airplane	90	1,000,000,000
	0.8"	4.7"	2.2'	Noise in Subway	80	100,000,000
	2.7"	15. "	7. '	Noise in Stenographic Room	70	10,000,000
1.5"	8.5"	4. '	22.2'	Noise 34th and 6th Ave., N. Y. C.	60	1,000,000
4.7"	2.2'	12.5'	70. '	Interior of R. R. Train	50	100,000
15. "	7. '	39.5'	222. '	Noisy Office	40	10,000
4. '	22.2'	125. '	704. '	Quiet Office	30	1,000
12.5'	70. '	395. '	2220. '	Sound Level in Country Residence	20	100
39.5'	220. '	1250. '	1-1/3 miles	Threshold of Intelligibility	10	10
				Threshold of Audibility		1

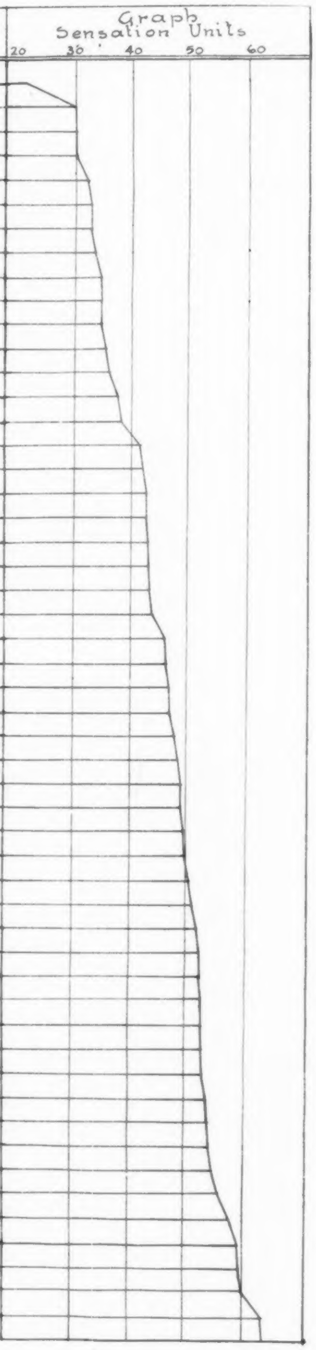
†Sensation Units are equivalent to "decibels" or 1/10 of a "bel" or 1/10 of a "log" (logarithm of reduction factor).

			Sensation Units
Example:	Probable sound:	Loud conversation	6
	Desired:	Sound Level in N. Y. apt.	2
	Required insulation		4

Refer to table of insulating values for type of wall to be used.

*Adapted from table prepared by Harvey Fletcher, of the Bell Telephone Laboratories.
Fletcher, Harvey, *Speech and Hearing*, D. Van Nostrand Company, Inc., New York.

Panel No.	Kind of Stud	Kind of Lath	Kind of Plaster	Plaster Coats	* Sensation Units
55	Wood		1/2" Celotex	One side only	23.1
6	"	Wood	Gypsum	3 coat, smooth finish	31.4
52	"		1/2" asbestos millboard	One side only	31.5
56	"		2 layers celotex, layer of hair felt between, one side only		31.6
30a	Gypsum tile		Gypsum	2 coat, smooth finish, one side only	33.5
20	Metal	Metal	"	3 coat, smooth finish	34.1
59	"	"	"	2" solid partition	34.1
57	Wood		Sheetrock	One side only	34.8
59a	Metal	Metal	Gypsum	Two 2" solid partitions with 2" air space	35.7
29	Gypsum tile		Lime	2 coat, smooth finish	35.8
51	Wood		Gypsolite	Both sides	35.8
20a	Metal	Metal	Gypsum	3 coat, smooth finish	36.4
24	"	Plaster	"	Solid partition	37.0
27	Clay tile		Lime	2 coat, smooth finish	38.5
28	" "		Gypsum	" " " "	39.1
22	Metal	Metal	"	Solid partition	42.1
2	Wood	Wood	"	Scratch coat only	42.6
25	Brick		Lime	2 coat, smooth finish	43.1
30b	Gypsum tile		Gypsum	" " " ", both sides	43.1
44	Wood	Metal	Gypsum wood-fibred	Scratch & brown coats only	43.4
50	"		Sheetrock	Both sides	43.5
4	"	Wood	Gypsum	Scratch & brown coats only	43.7
43	"	Metal	Gypsum wood-fibred	" " " " "	44.0
45	"	"	" " "	3 coat, smooth finish	46.3
26	Brick		Gypsum	2 " " "	46.4
42	Wood	Sheet metal	"	3 " " "	47.0
46	"	Metal	Gypsum wood-fibred	" " " "	47.0
47	"		5/8" Gypsum wall board decorated with wall paper		48.0
59b	Metal	Metal	Two 2" solid gypsum part., 2 layers 1" hair felt, 2" air space		48.5
16	Wood	Wire	Gypsum	3 coat, smooth finish	49.0
59c	Metal	Metal	Same as 59b with additional layer 1" hair felt in air space		49.0
59d	"	"	" " "	layer of Cabots quilt in air space	49.4
38	Wood	Wood	Lime & gypsum	Gypsum scratch, lime brown, smooth fin.	49.5
13	"	"	Lime	3 coat, sand finish	50.5
14	"	"	Gypsum	" " " "	51.0
10	"	Metal	"	Scratch & brown coats only	51.7
8	"	"	"	Scratch coat only	52.1
41	"	Plaster bd	"	3 coat, smooth finish	52.1
18	"	Plaster	"	" " " "	52.6
30c	Gypsum tile		"	Two panels as 30a, with 1½" air space	52.6
1	Wood	Wood	Lime	Scratch coat only	52.7
58	"		2 layers Sheetrock, 1" layer hair felt between, one side only		52.8
12	"	Metal	Gypsum	3 coat, smooth finish	53.1
39	"	Wood	Lime & gypsum	3 coat, lime & Keene's cement, smooth fin	53.5
5	"	"	Lime	3 coat, smooth finish	53.8
59e	Metal	Metal	Same as 59b with layer of celotex in air space		54.1
11	Wood	"	Lime	3 coat, smooth finish	55.3
7	"	"	"	Scratch coat only	57.2
15	"	Wire	"	3 coat, smooth finish	58.7
3	"	Wood	"	Scratch & brown coats only	58.9
40	"	Metal	"	3 coat, smooth finish	59.2
37	"	Wood	Lime & gypsum	Lime scratch, gypsum brown, smooth finish	62.5
9	"	Metal	Lime	Scratch & brown coats only	62.9



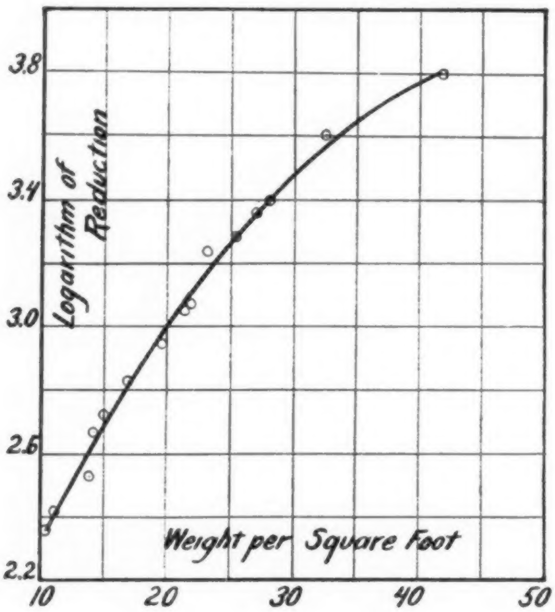
This table is a combination and adaptation of two tables of the Bureau of Standards, Nos. 552[1] and 526[2].

** At the present time there is no generally accepted standard unit for measurement of sound. The Bureau of Standards has in the past used the "Logarithm of the reduction of physical intensity" as a unit of measure, but their forthcoming papers will use the "Sensation Unit" which is equivalent to 1/10 of the "log." The Riverbank Laboratories and Burgess Laboratories use the "log" but their tests are conducted in a different manner from the Bureau of Standards and the results are not directly comparable in terms of "log of reduction." The telephone, radio and phonograph companies use the term "bel" or "decibel" (a unit developed by the Bell Telephone Laboratories). The "bel" is equivalent to a "log" and the "decibel" is 1/10 of a "bel," or equivalent to a Sensation Unit. The American Acoustical Society now being formed, or the Acoustical Committee of the American Society of Mechanical Engineers will establish definite units and standard test methods.

* "A frequency of 250 cycles corresponds to middle C, an average between the male and female voice."

III. Sound Transmission Through Walls and Floors. Sound transmission may be retarded by mass, structural independence, breaks in density and use of absorptive materials.

(A.) Solid Walls. This graph and table indicate that for *single walls* constructed of *homogeneous* ma-



Tests		Average Log of Reduction	Mass per Sq. Ft.	Relative Stiffness	Average Reduction
1	2 in. gypsum unplastered	2.36	10.4	...	230
2	3 in. hollow gypsum unplastered	2.42	11.1	...	260
3	1.5 in. plaster on lath	2.53	13.9	4	340
4	3 in. solid gypsum unplastered	2.67	14.2	...	468
5	2 in. solid gypsum + 0.5 in. plaster	2.72	15.0	...	525
6	4 in. hollow clay tile unplastered	2.83	17.0	...	677
7	2 in. solid gypsum + 1 in. plaster	2.95	19.6	...	892
8	2 in. solid gypsum + 1.25 in. plaster	3.05	21.4	84	1120
9	4 in. clay tile + 0.5 in. plaster	3.07	22.0	...	1180
10	2.5 in. plaster on lath	3.24	23.2	17	1740
11	3 in. solid gypsum + 1.25 in. plaster	3.28	25.4	130	1910
12	4 in. clay tile + 1 in. plaster	3.36	27.0	...	2300
13	4 in. clay tile + 1.25 in. plaster	3.40	28.0	120	2500
14	3.5 in. plaster on lath	3.60	32.5	77	4000
15	4.5 in. plaster on lath	3.82	41.8	...	6600

Industrial and Engineering Chemistry—Paul E. Sabine*4

RELATION OF MASS TO SOUND INSULATION

terial, mass rather than stiffness is the determining factor in the general reduction of sound intensity. Sound reduction and mass per square foot follow the same order. Recent tests indicate that single sheets of metal have the same sound insulating value as fiber board of the same weight.

"Extrapolating the curve, it appears that for a log of four a masonry wall weighing 50 pounds per square foot would be required, a figure which for cost and structural loading would be excessive"(*4) for partitions, but practical for sustaining or fire walls.

(B.) Bridged and Unbridged Double Partitions. The transmission of sound by each wall is affected by the presence of the other even with the 4-inch separation, which indicates that there is a reaction between the two walls across the intervening air space.

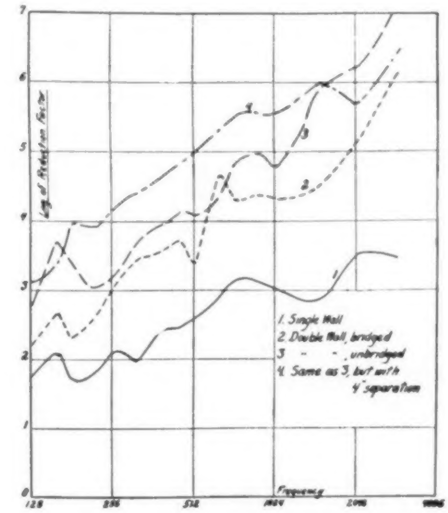


Figure 3.

The Armour Engineer—Paul E. Sabine'

INSULATING VALUE OF SINGLE AND DOUBLE WALLS

The effect of bridging air space is shown in the above graph by comparison of Curves 2 and 3. Curve 2 shows transmission when a wood strip 1 inch by 2 inches is in contact with both walls the entire length from top to bottom as in frame construction. This indicates how sound is transmitted through studding.

There is a decided difference of opinion as to the value of "sound deadeners" in the space between floor joists and wall studs. Mineral wool, cork, slag, felt and fibrous vegetable material and wood pulp have been employed with varying results.

Although the results of tests by the Bureau of Standards and Paul E. Sabine indicate that these "sound deadening" materials have slight value when used in connection with frame or masonry walls, in actual practice they appear to have a value not indicated in laboratory tests. Furthermore, experiments in sound insulation of airplane cabins and Wallace C. Sabine's experiments with sheet steel and felt, indicate that insulating felt has considerable sound insulation value when used as a filler for metal walls. It is to be hoped that there will be field tests to bring out the value of these materials under actual building conditions.

(C.) Comparison of Double and Single Wall Partitions. "The unbridged, unfilled wall [2 walls of 2-inch solid gypsum tile] with a 2-inch separation, has about the same insulating value as 6¾ inches of brick, while the unbridged wall, with 4-inch separation, is equivalent to 10½ inches of solid masonry."*5

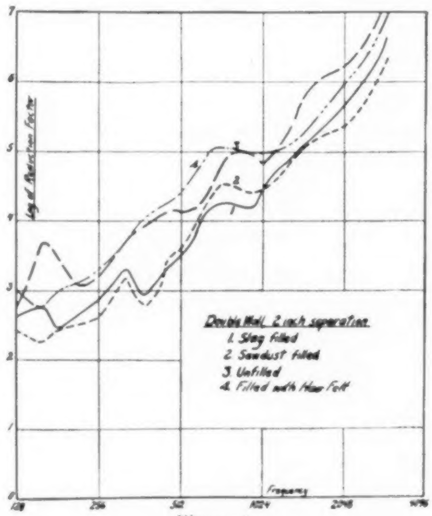


Figure 4.

The Armour Engineer—Paul E. Sabine

EFFECT OF FILL ON SOUND INSULATION

(D.) Floors and Ceilings. The difference between air-borne and impact sound is clearly illustrated when one recalls that a shout from behind a closed window will not be heard across the street while a pencil tap on the window will readily attract attention.

The sound insulation values given in table on page 293 are for air-borne noises, but experience has shown that air-borne sounds are not as serious an annoyance to the occupants of the room below as impact noises of walking, vibrations from piano or other sources of sound transmitted directly to the floor.

Impact noise may be lessened by covering floors with cork, rubber or other resilient material. If battleship linoleum is used, fiber insulating board may be used as a cushion. The board should be cemented to wood or concrete floor and linoleum cemented to it.

Aside from lessening noise from impact sound, transmissions will be further reduced by using a "floated floor," or an independent or suspended ceiling, as shown in sketches, pages 296 and 297. Recent experiments indicate that a "floated floor" is more effective as insulation against transmission of impact noises than a hung ceiling. When a "floated floor" is used, the finished floor is nailed to sleepers and the sleepers are floated on a cushion of insulation board or quilt, or the sleepers are carried on spring or felt saddles as shown in the drawings. If a separate ceiling is installed, care must be taken that there is no connection between the floor and ceiling by through conduits, scraps of lumber or plaster. If a hung ceiling is used, care must be taken to obtain proper installation of insulated hangers and any uninsulated structural connection between floor and ceiling avoided.

IV. Field Tests. We have been able to locate only two cases where scientific sound transmission tests have been made of sound insulation methods in completed buildings. The Burgess Laboratories made a series of tests concerning which they write as follows:

". . . . The apparatus used in making the tests consisted of an electric horn which generated a sound of definite intensity—the pitch varied continually between 500 and 525 cycles per second, this range being chosen because it is the average range of speech sound. In conjunction with this instrument, a second instrument which registered the sound intensity directly on a scale was employed. The method of testing was as follows:*

"The sound producing instrument was set up in a room above the floor to be tested. The sound was started and a measurement was taken of the intensity at the floor level in this room. The sound was allowed to continue and the measuring instrument was carried to the floor below, care being taken to close off all direct passages that the sound might travel from one floor to the other. The instrument was set up in the room below that in which the noise was being generated, and the sound intensity measurement was taken. The *ratio* of the *sound intensity* in the two rooms was obtained from a ratio of the readings and from this value the sound reduction of the floor was determined.

"In tests made of a floor of the following construction:

Lath and plaster ceiling
2″ x 8″ joists on 16″ centers
Rough floor laid diagonally
1″ x 2″ sleepers
Finished floor of kiln dried maple

it was found that the logarithm of reduction varied from a value of 2 to a value of 3.5, depending upon the span and tightness of construction. It is probable in the average building where no particular care is taken to insure the bridging being particularly firm and when the floor is laid with ordinary labor, the

* It is very important to bear in mind that the "log" values, although reliable as an indication of the relative insulation values of different types of floors in this series of tests should not be compared with "log" values of other materials as tested by other laboratories as the test methods used differ considerably.

logarithm of reduction will prove to be not much over the lower value of 2.0.

"One of the floors investigated consisted of a construction very similar to the above, with the exception that strips of felt one-half inch thick and two inches wide were laid under the sleepers and the space between the rough and finished floors was filled with *Sprayo-Flake*. The logarithm of reduction of this floor proved to be 3.674. This, while not high enough to extinguish speech sounds entirely, reduced their audibility to such a degree that words were not intelligible.

"The other floor under test was of slightly different construction. It consisted of lath and plaster ceiling, 2" x 8" joists spaced on 18" centers, diagonally laid rough floor with 3/4" *Sprayo-Flake* applied to the under side of the rough floor between the joists, 1/2" felt strips and 5/8" sleepers nailed to the rough floor, and a fill of 1 1/8" of dry *Sprayo-Flake* laid between the sleepers before the finish floor was applied. Paper was laid over the sound insulation and the finish floor nailed to the sleepers. On test, this floor showed a logarithm of reduction of 4.081 . . . .This approaches very closely to the ideal range."

. . . .

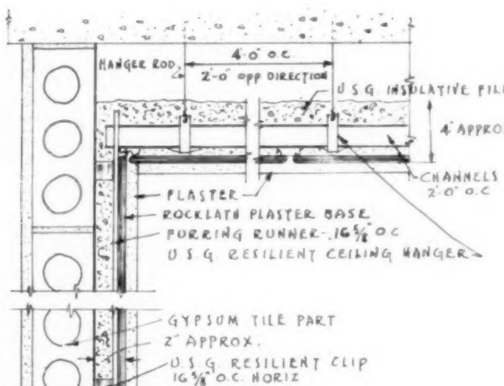
"It is interesting and encouraging to find that with proper insulation it is possible to make a floor of standard wood construction which will be for all practical purposes soundproof. It has been the opinion that to obtain sound-proofing of this quality, it was necessary to go to concrete or tile construction. The above test, however, indicates that with careful insulation the ordinary wood construction can be made satisfactorily soundproof for duplex or apartment house use." (C. F. Burgess Laboratories, Inc. R. F. Norris.)

It should be noted that in ordinary floor construction with no deadening, the log of reduction factor varies from 2. to 3.5 depending upon the span and tightness of construction and with sound deadening from 3.67 to 4.08. A log of 2 is equal to 20 sensation units.

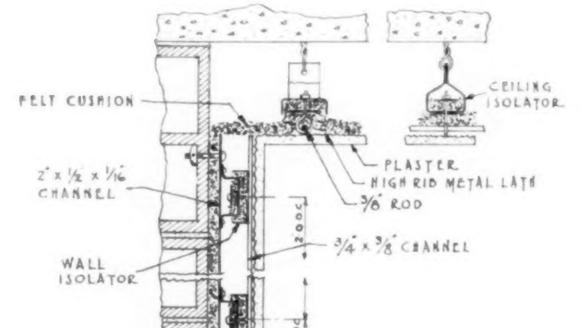
SOUND INSULATION SYSTEMS

GUARANTEED SYSTEMS

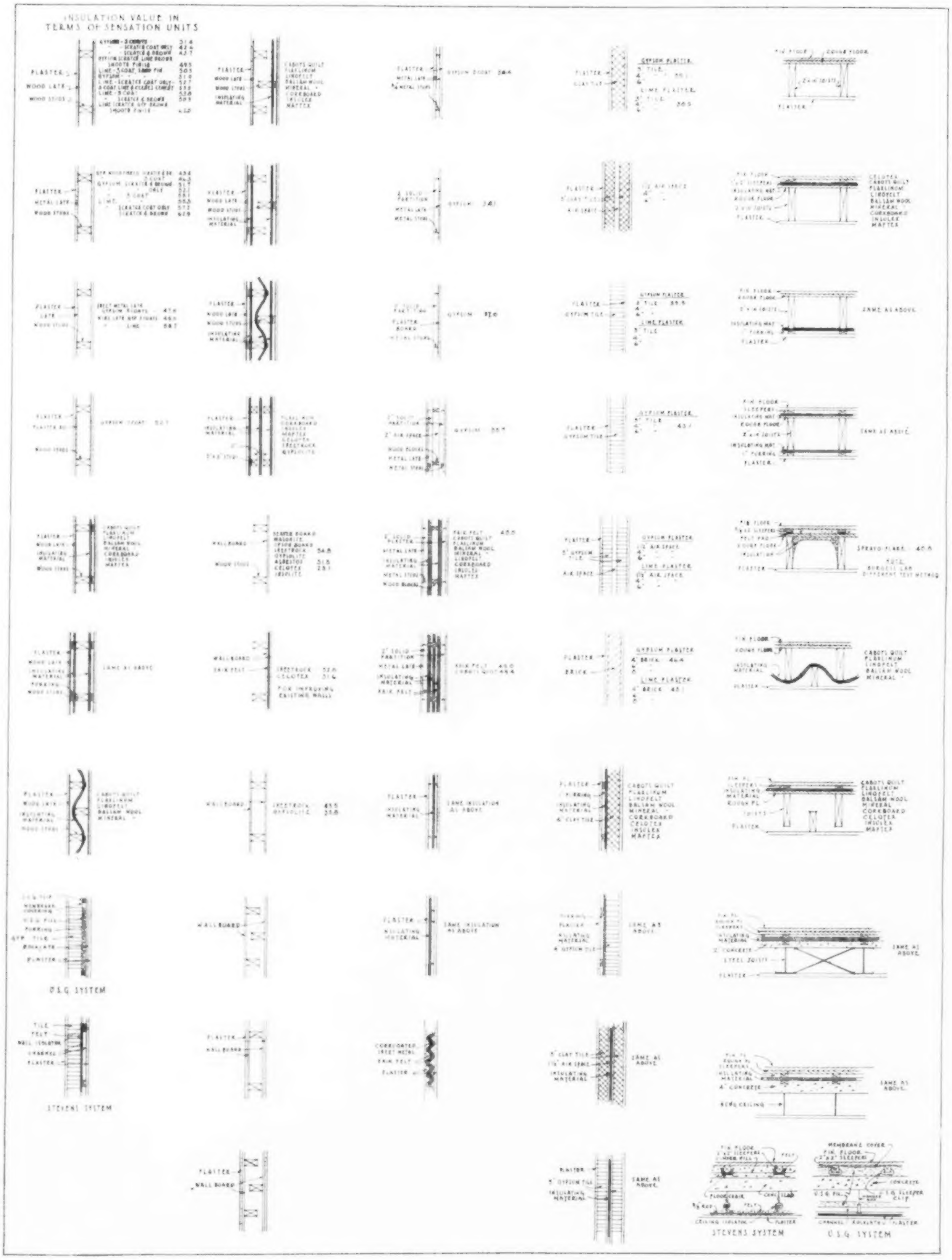
There are certain systems of sound insulation now on the market. Their manufacturers make recommendations and contract for the installation of their systems on a guaranteed basis. These systems have their principal items of floor, wall and ceiling con-



· U.S.G. · SYSTEM · OF · SOUND · INSULATION ·



· STEVENS · SYSTEM · OF · SOUND-PROOFING ·
· FOR · FIRE-PROOF CONSTRUCTION ·



WALL AND FLOOR CONSTRUCTION WITH METHODS OF SOUND INSULATION
There is a lack of sound insulation data for the majority of methods

struction based on separating the finishing surface of the floor, wall or ceiling from its component structural parts by means of resilient devices. The U. S. Gypsum Company primarily makes use of metallic spring devices, while the Stephens Company uses devices with hair felt pads. It is preferable to have each of these constructions installed by the manufacturer under his guarantee rather than to allow the general contractor to attempt the work.

COSTS OF GUARANTEED SYSTEMS

Sound insulative partition furring, when installed on one side only of a masonry partition will cost, when installed complete, ready for plastering by others but not including the tile partition wall, from 30 to 60 cents per square foot depending upon the size and location of the job.

Sound insulative suspended ceiling construction complete, ready for plastering by others, the general contractor to furnish and install the necessary wire rod hangers in the masonry slab above, will cost from 50 cents to $1.00 per square foot depending upon the size and location of the job.

Treatments of mechanical equipment such as elevator machinery, ventilating fans, vent ducts and piping will vary so greatly with the nature of the job that it is impossible to give approximate prices.

VIBRATIONS FROM ELEVATORS, VENTILATING SYSTEMS AND MACHINERY

Special care must be taken to insulate against noise or vibration from machinery. Elevator shafts may be carried free of main structure to minimize vibration. Elevator machinery should be carefully insulated to prevent transfer of noise or vibration to the structure of the building. As an additional precaution it is advisable to locate service or living rooms near an elevator shaft rather than bedrooms. If a penthouse apartment is provided near an elevator, unusual care must be exercised.

Pumps and other machinery should be carried on a spring, felt or cork base and all ducts or pipes should have flexible connections.

CAUTIONS IN USE OF ANY TRANSMISSION VALUES

1. There are today no standard methods or units for measuring sound transmission. The use of the term "logarithm of reduction factor" together with vibration rate would seem to indicate that the same test method was used by all laboratories using this unit. There are, however, so many additional elements, such as the size of the panel tested, workmanship, age of plaster and method of measuring the reverberation period or intensity of sound transmitted, that it is not safe to compare tests made at one laboratory with those made at another. Furthermore, tests at the same laboratory may be given in terms of various pitches or the mean of all vibration rates tested. This accounts for the difference between sound insulation values as given by the National Lumber Manufacturers Association and those given in this article. Both tables are taken from the Bureau of Standards' scientific papers Nos. 526 and 552. The Lumber Association use the mean of tests for various vibrations and the tables in this article are given for 250 cycles.

2. Sound insulation is largely a construction problem and the area, span, workmanship and transmission qualities of adjoining walls or floors will affect the transmission to a large degree.

3. A wall is only as good as its weakest point. A door or other opening, unless specially sound insulated, will neutralize the effect of sound insulation to a large extent.

4. Attention is called to the fact that air ducts, unless insulated, will transmit sound. The importance of this factor is evident from a comparison of the distance a voice travels with various insulation factors. (See table, page 292).

5. The sound insulation factors given apply to air-borne sounds only.

6. For complete sound insulation it is advisable to call in an acoustical expert or a reliable acoustical company.

7. There is not enough definite engineering information at the present time to enable anyone to say which of the many suggested methods of sound insulation construction give the best results per dollar.

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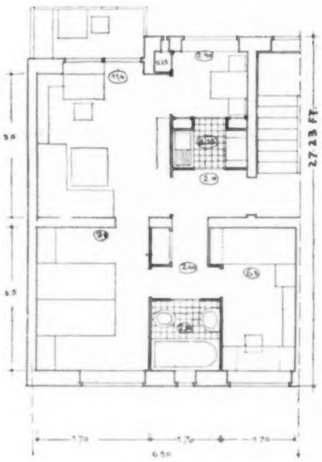


Fig. (a)
Area 435 sq. ft.; 3 beds
145 sq. ft. per bed

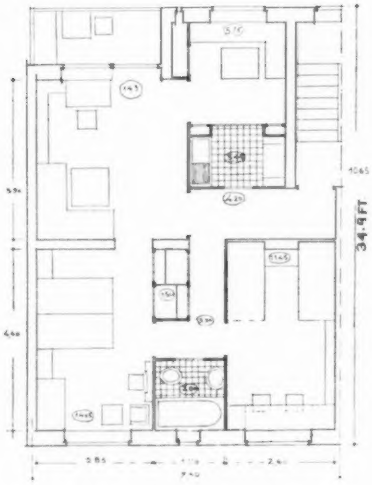


Fig. (b)
Area 639 sq. ft.; 4.5 beds
142 sq. ft. per bed

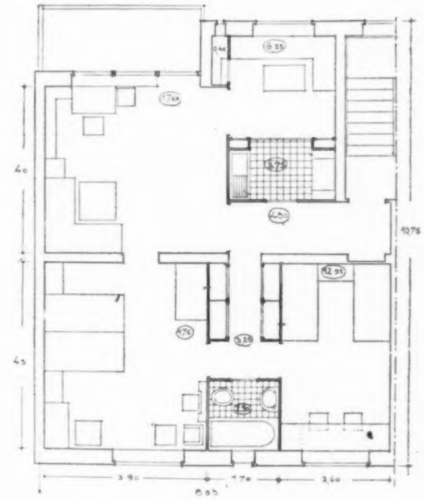


Fig. (c)
Area 752 sq. ft.; 4.5 beds
167 sq. ft. per bed

Studies submitted in a recent competition in Germany for House-Planning. The three plans above were considered to be among the most economical shown.

Fig. (d)
Ground floor plans as originally laid out

Fig. (e)
Designer's study of a ground floor plan of same dimensions as Fig. (d). Staircase moved to avoid through-passage on ground floor

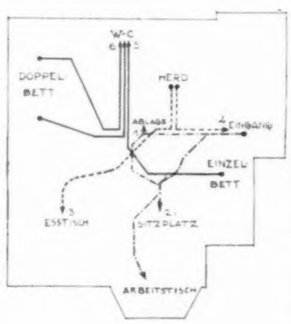


Fig. (f)
Diagram showing lines of traffic direction in plan Fig. (d). For daily activities cross-traffic is necessary

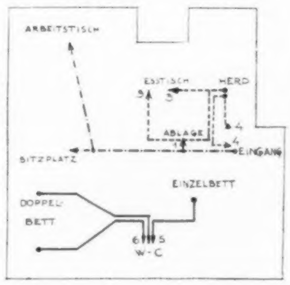


Fig. (g)
Diagram of traffic direction in plan Fig. (e). Cross-traffic avoided by the new position of house entrance

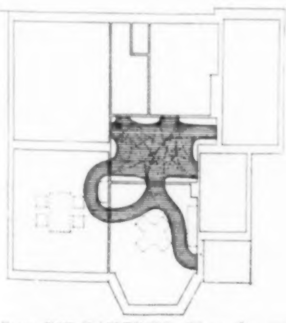
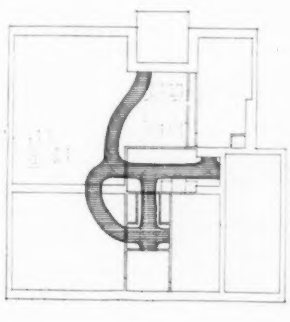


Fig. (h)
Shaded section indicates wasted space in arrangement Fig. (d). Seating in living, dining room and hall is inefficient

Fig. (i)
Shaded section indicates space taken up by traffic lanes when floor is arranged as in Fig. (e)



From *DIE BAUGILDE*, November 29, 1927

ILLUSTRATIONS OF GERMAN EFFICIENCY STUDIES

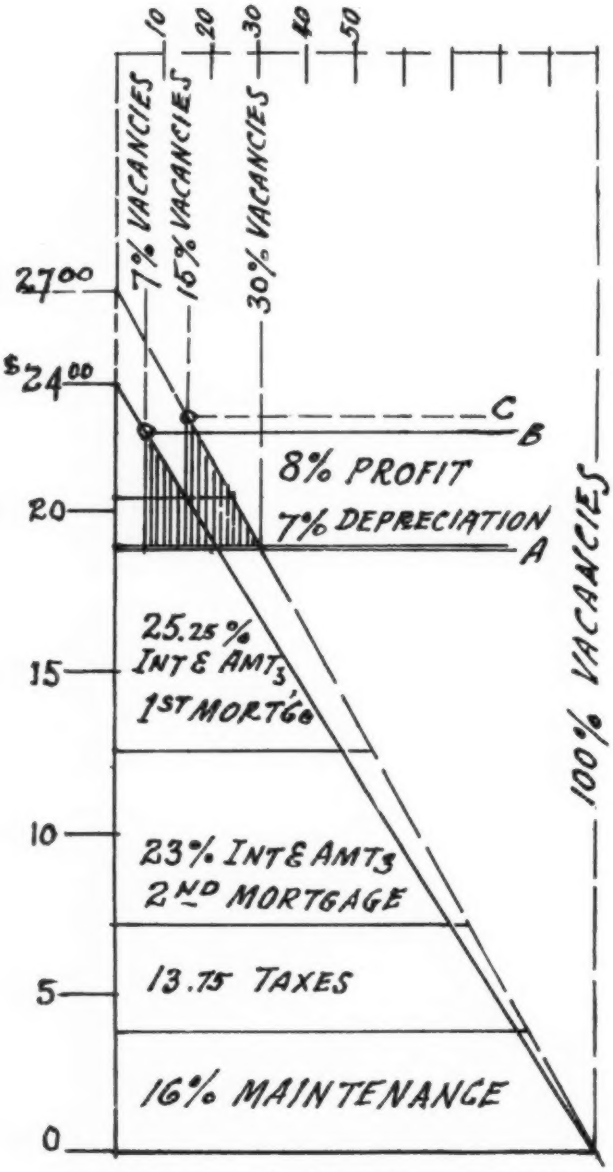


DIAGRAM OF FACTORS WHICH UNDERLY RENT AND PROFIT

The items correspond with financial set-up of Hypothetical Project, pages 242-245 of this issue. Note the delicate balance between rate of rental and vacancy losses. For example, an increase of 12½% in rental (from $24 to $27 per room, per month) will be almost neutralized by an increase of vacancies from 7% to 15%, so that the margin of profit is unchanged, while an increase of vacancies to 22% will in this case wipe out the profit altogether.

EFFECT ON COSTS OF VARIATION IN ROOM SIZE

UNIT	10′ x 12′ Room		12′ x 18′ Room	
	Area or Units	Cost	Area or Units	Cost
Floor and Ceiling at 50¢ per sq. ft. (Note 1)	120 sq. ft.	$ 60	216 sq. ft.	$108
Basement and Roof $3 per sq. ft. total cost	120÷4 floors	$ 90	216÷4 floors	$162
Walls:				
Exterior, $1.00 per sq. ft.	90 sq. ft.	$ 90	108 sq. ft.	$108
Interior, 50¢ per sq. ft. (Note 2)	272 sq. ft.	$136	384 sq. ft.	$192
Total of Variable Costs		$376		$570
Windows at $25 (Note 3)	1	$ 25		$ 25
Doors at $25	2	50		50
Halls and Stairs	200	25		25
Equipment:				
Plumbing, gas, and tile bath	$600÷4 rooms	150		150
Lighting and Fixtures		20		20
Heating at $60 per room	1	60		60
Kitchen Cabinets, etc.	$100÷4 rooms	25		25
Total Non-Variable Costs		$355		$355
		376		570
Total		$731		$925
Architect's Fee 6%		44		55
Total		$775		$980

$775÷120 sq. ft.=$6.45 per sq. ft.÷12=$0.54 per cu. ft.
$980÷216 sq. ft.=$4.54 per sq. ft.÷12=$ .38 per cu. ft.

These cubic foot costs correspond very closely to costs of two large New York model tenements of about the same room sizes.

(1) Fireproof, $1 per sq. ft.
(2) Fireproof nonbearing, 50¢ per sq. ft.
(3) Window costs include all such items as lintels, trim, calking, and painting. All walls have been figured solid and the cost of wall occupied by doors and windows subtracted from window cost. Plaster cost has not been deducted, as plaster contractors, in general practice, make no deduction for openings.
(4) There may be a slight increase in radiation required for larger room sizes but where the exterior wall area remains practically the same and there are the same number of windows, the increased radiation required can be ignored in an analysis such as this.

An increase of 80% (216−120=96) in floor area only increases cost of rooms 27% (970−767=204).

From the above analysis it will be seen that the cubic foot method of estimating is not satisfactory when comparing buildings having rooms of widely different sizes.

COMPARISON OF ONE ROOM AND KITCHENETTE WITH FOUR ROOM APARTMENT

UNIT	One Room Kitchenette		Four Room Plan No. 1	
	Area or Unit	Cost	Area or Unit	Cost
Floor and Ceiling at 50¢ per sq. ft.	472 sq. ft.	$236.00	725 sq. ft.	$362.50
Basement and Roof at $3 per sq. ft. total cost	472÷4 floors	354.00	725÷4 floors	543.75
Walls:				
Exterior, $1 per sq. ft.	202 ft. 6 in.	202.50	450	450.00
Interior, 50¢ per sq. ft.	747	373.50	1215	607.50
Total Frame		$1166.00		$1963.75
Windows, $25	3	$ 75.00	5	$125.00
Doors, $25	5	125.00	9	225.00
Halls and Stairs (included in gross area)	(½ of 5′ hall in gross area)		(½ of stairs and hall)	
Equipment:				
Plumbing, Gas and Tile Bath		$600.00		$600.00
Lighting and Fixtures		60.00		80.00
Heating at $60 per room		200.00		240.00
Kitchen Cabinets, etc.		100.00		100.00
		$2326.00		$3333.75

An increase in cost of 43% ($3333.75−$2326.00=$1007.75) gives an increase of gross floor area of 54% (725−472=253 sq. ft.) or net increase of 43% (576−402=174 sq. ft.)

FIREPROOF vs. NON-FIREPROOF

(See opposite page)

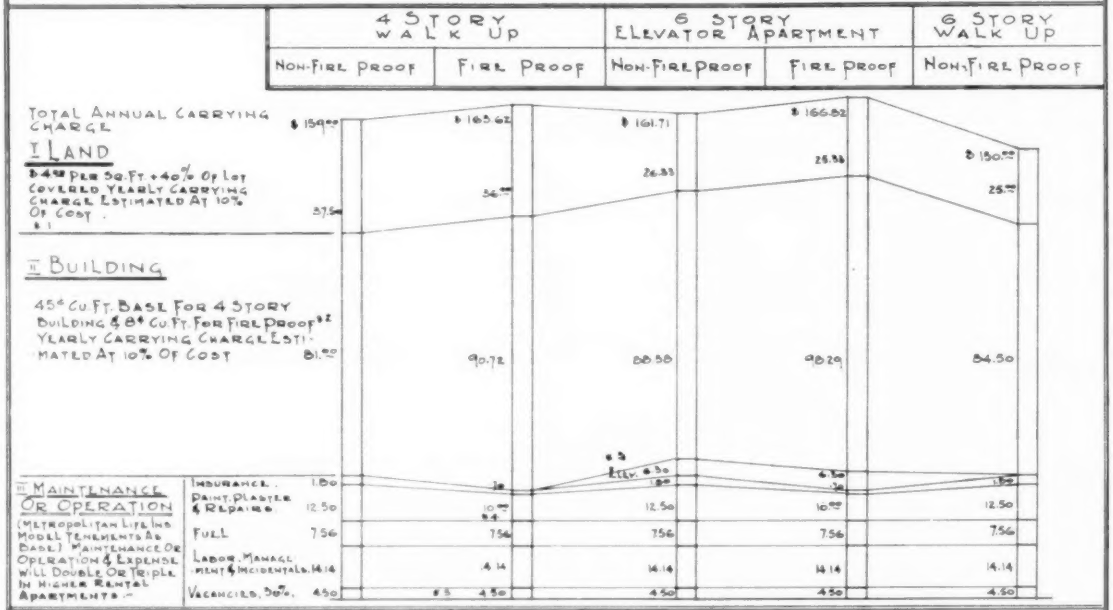
The carrying charges, over a period of five or more years, are no greater on a fireproof than on a non-fireproof apartment building. The reasons why this fact is not more generally recognized are:

1. The average contractor builds to sell and is not affected by cost of repairs. This fact is too well known to need further comment.

2. The average owner does not keep an accurate record of his repair costs and their causes. Although his plaster and paint repairs are high he fails to realize that they would be sufficiently less in a fireproof building to make it a better investment.

3. The major cause in most cases is general inertia and failure on the part of the owner to analyze the entire problem, although in some localities, because of special conditions, non-fireproof floor construction may be more profitable.

— A METHOD FOR ANALYZING RELATIVE ANNUAL CARRYING CHARGES ON BUILDING & LAND FOR VARIOUS TYPES OF BUILDINGS —



RELATIVE COST ANALYSIS FOR ABOVE GRAPH

	4 STORY WALK UP		6 STORY ELEVATOR AP'T		6 STORY WALK UP
	NON FIRE PROOF	FIRE PROOF	NON FIRE PROOF	FIRE PROOF	NON FIRE PROOF
ROOM	*6 $4.50 × 150 = $675.00	*7 $5.22 × 144 = $751.68	*8 $4.50 × 158 = $711.00	$5.22 × 152 = $793.44	$4.50 × 150 = $675.00
BASEMENT	$\frac{\$3.60 \times 150}{4 \text{ STORIES}}$ = $135.00	$\frac{4.32 \times 144}{4}$ = 155.52	$\frac{3.60 \times 158}{6}$ = 94.80	$\frac{4.32 \times 152}{6}$ = 109.44	$\frac{3.60 \times 150}{6}$ = 90.00
ELEVATOR			80.00	80.00	80.00
TOTAL BLDG.	$810.00	$907.20	$885.80	$982.88	$845.00
TOTAL LAND	40% COVER $\frac{4 \times 2.50 \times 150}{4 \text{ STORIES}}$ = $375.00	$\frac{4 \times 2.50 \times 144}{4 \text{ STORIES}}$ = $360.00	$\frac{4 \times 2.50 \times 158}{6 \text{ STORIES}}$ = $263.33	$\frac{4 \times 2.50 \times 152}{6 \text{ STORIES}}$ = $253.33	$\frac{4 \times 2.50 \times 150}{6 \text{ STORIES}}$ = $250.00
TOTAL BLDG & LAND	$1185.00	$1267.20	$1149.13	$1236.21	$1095.00
YEARLY CARRY CHARGE 10%	$118.50	$126.72	$114.91	$123.62	$109.50

NOTES:

*1 — THE PERCENTAGE CARRYING CHARGE WILL VARY WITH EVERY BUILDING DEPENDING ON FINANCING CHARGES, RATE OF INTEREST, TAXES AND AMORTIZATION. THIS ANALYSIS IS GIVEN PRIMARILY AS AN INDICATION OF METHOD. THE NEW YORK STATE HOUSING BOARD USES A FIGURE OF 10.5% FOR ESTIMATING THE ANNUAL CARRYING CHARGE ON LAND. THIS INCLUDES FINANCING COSTS. FIVE PER CENT INTEREST ON A ⅔ FIRST MORTGAGE, SIX PER CENT ON EQUITY. TWO PER CENT AMORTIZATION OF THE MORTGAGE AND TWO AND SEVEN TENTHS PER CENT TAXES. THE CARRYING CHARGES ON THE BUILDING, WICH IS TAX EXEMPT, IS ESTIMATED AT SEVEN AND FIVE TENTHS.

*2 — THE ADDITIONAL 8¢ PER CU. FT. FOR FIREPROOF CONSTRUCTION HAS BEEN ARRIVED AT BY COST ANALYSIS OF EXISTING APARTMENT HOUSES AND HAS BEEN VERIFIED BY ONE OF THE LARGE AND CONSERVATIVE CONSTRUCTION COMPANIES. THIS 8¢ IS THE ACTUAL ADDITIONAL COST OF FIREPROOF OVER BRICK CONSTRUCTION WITH FRAME FLOORS AND DOES NOT ALLOW FOR HIGHER CLASS EQUIPMENT AND ELEVATORS ORDINARILY INSTALLED IN A FIREPROOF BUILDING.

*3 — THIS OPERATING CHARGE OF $6.30 INCLUDES POWER, REPAIRS, DEPRECIATION, LIABILITY INSURANCE AND INCIDENTALS ON A "PUSH BUTTON TYPE" OF ELEVATOR. OPERATING COSTS ON ELEVATOR HAVING AN OPERATOR WOULD BE CONSIDERABLY HIGHER. ELEVATOR COSTS WILL VARY WITH DIFFERENT TYPES OF BUILDINGS. —

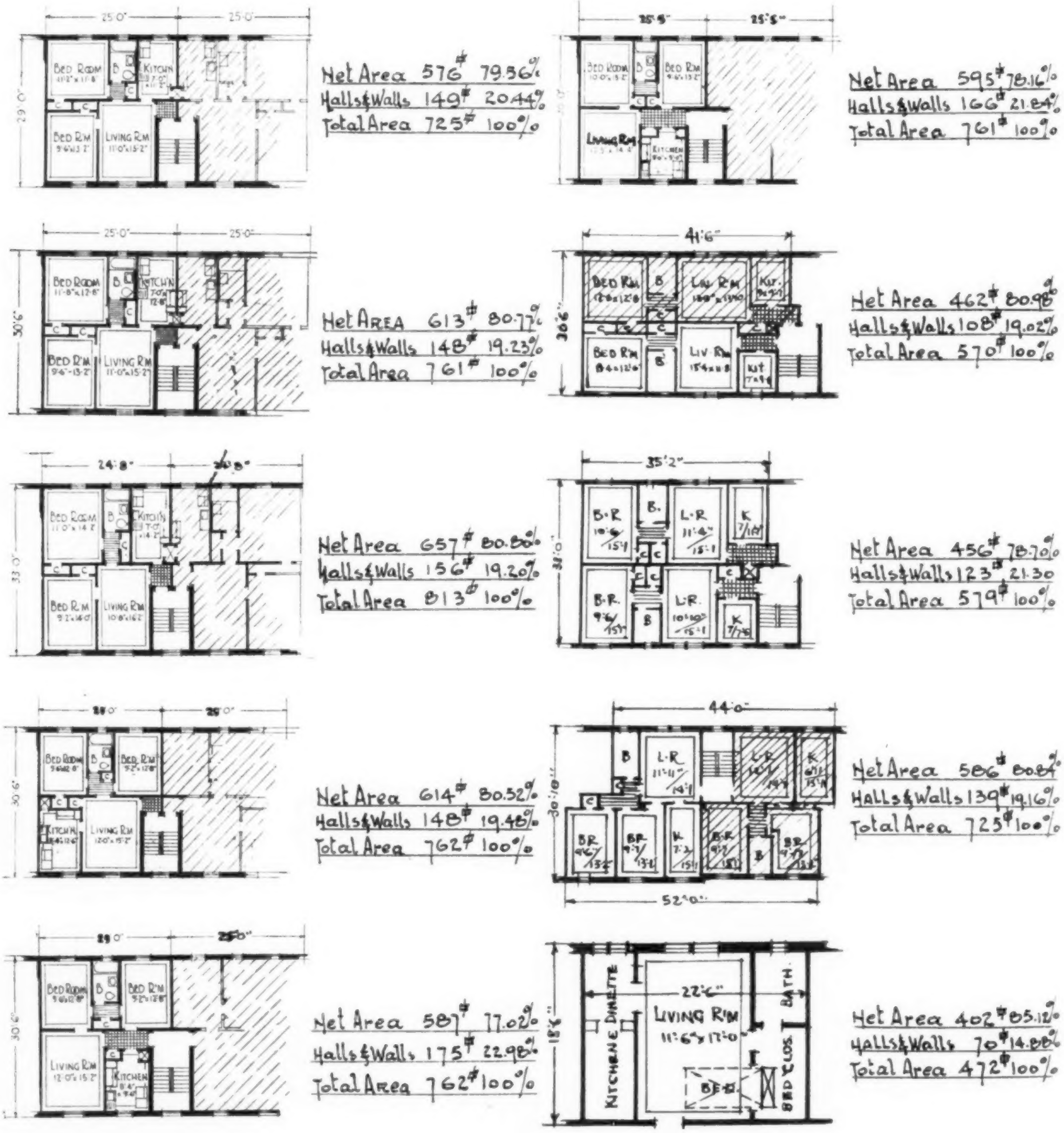
*4 — A STUDY OF MAINTENANCE COSTS SHOWS THAT A CONSIDERABLE AMOUNT IS SPENT EACH YEAR IN REPAIRING PLASTER CRACKS CAUSED BY SHRINKAGE OF LUMBER AND UNEVEN SETTLEMENT OF BUILDING. — IT IS ESTIMATED THAT AT LEAST $2.50 PER ROOM PER YEAR WILL BE SAVED ON PLASTER AND PAINT REPAIR WORK IF THE BUILDING IS OF FIREPROOF CONSTRUCTION.

*5 — VACANCIES SHOULD BE LESS IN A FIRE PROOF BUILDING DUE TO LESS DANGER FROM FIRE AND ELIMINATION OF MICE AND VERMIN. REAL ESTATE MEN REPORT A MUCH LOWER TURNOVER RATE IN FIRE PROOF BUILDINGS. THIS IS PARTLY DUE TO THE MORE MODERN CHARACTER OF EQUIPMENT IN MOST FIREPROOF BUILDINGS.

*6 — ASSUMING A TOTAL CU. FT. COST FOR NON-FIREPROOF CONSTRUCTION OF 45¢ CU. FT. A SINGLE FLOOR 8'-4" CEILING HEIGHT WILL COST $4.50 PER SQ. FT. PLUS COST OF BASEMENT DIVIDED BY NUMBER OF STORIES HIGH.

*7 — A FIREPROOF BUILDING UNDER MOST BUILDING CODES REQUIRES SIX SQ. FT. LESS GROSS AREA PER ROOM THAN A NON-FIREPROOF ROOM OF THE SAME NET AREA. THE DIFFERENCE IS DUE TO THE BUILDING CODE REQUIREMENTS FOR FIRE WALLS, STAIR WALLS ETC. AND IN PART TO THE THINNER PARTITIONS OFTEN USED IN FIREPROOF CONSTRUCTION. —

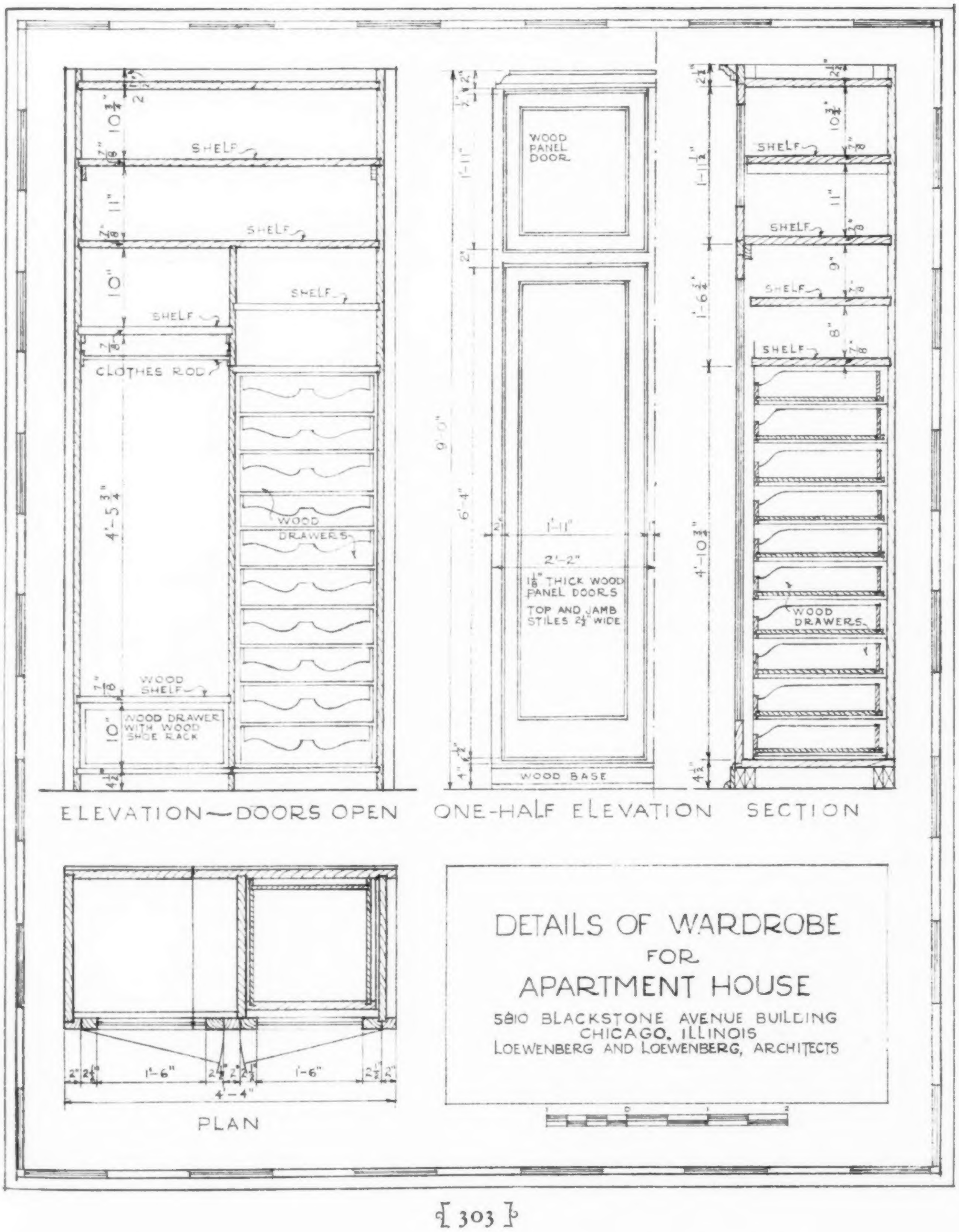
*8 — AN ELEVATOR APARTMENT IN THE PLAN USED FOR COMPARISON REQUIRES ABOUT 8 SQ. FT. MORE GROSS AREA PER ROOM FOR THE SAME NET ROOM AREA AS A NON-ELEVATOR APARTMENT. THIS AREA WILL VARY GREATLY WITH DIFFERENT TYPES OF FLOOR PLANS. —

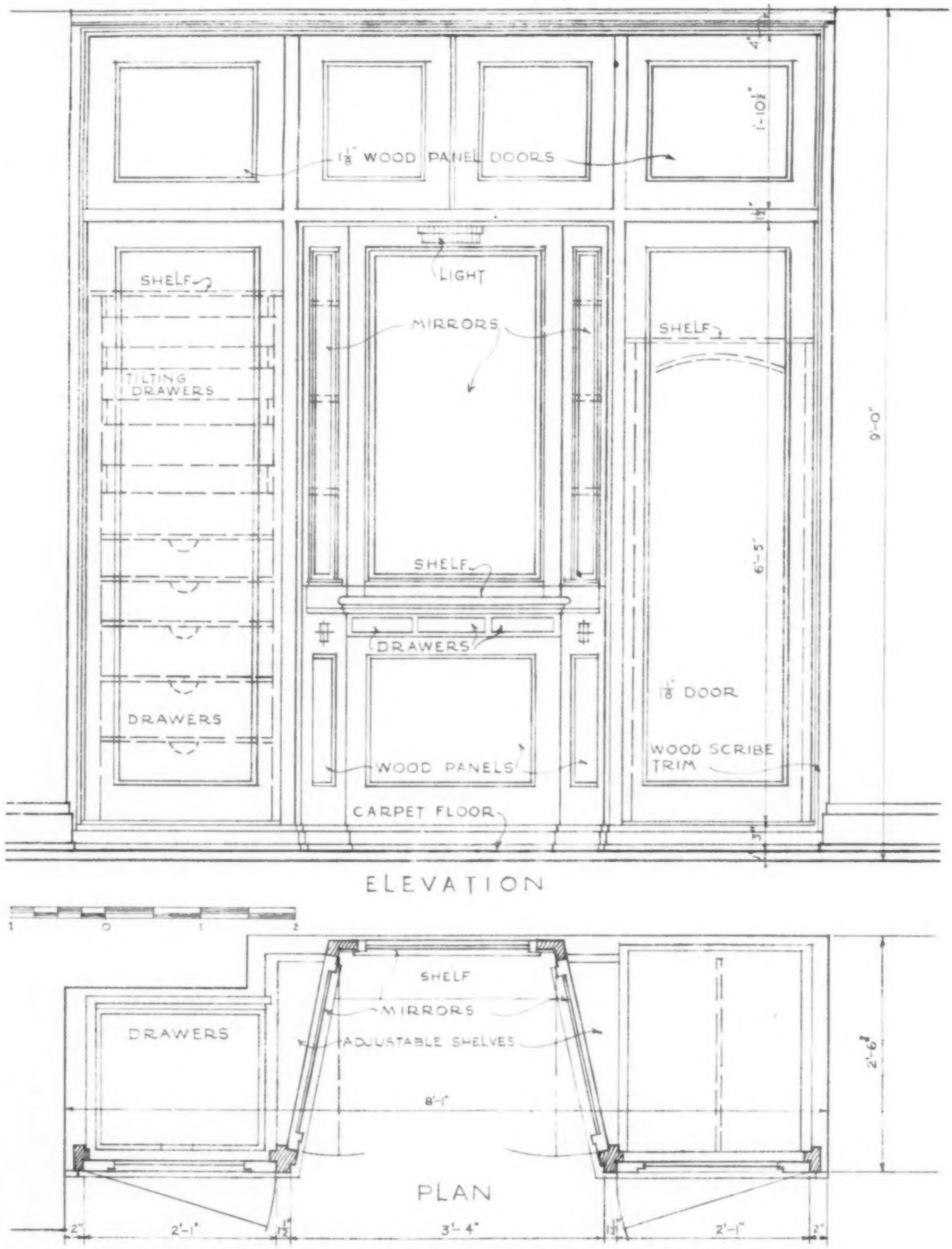


PLAN EFFICIENCY STUDY

The above typical plans will indicate that there are well-defined limits to efficient span depth for various types and sizes of apartments. The four-room apartment shown has an excess of bath-hall space for 33′ span as compared with the span of 30′ 6″, but for the three-room apartment the 33′ is preferable. For the "Efficiency Apartment" with a 5′ central hall, a 42′ span is very economical. If bath-halls are considered as *usable space* the net area for plans will be 78.2%, 78.7%, 78%, 77.8%, 75%, 76.1%, 78.5%, 76%, 78% and 85.12%.

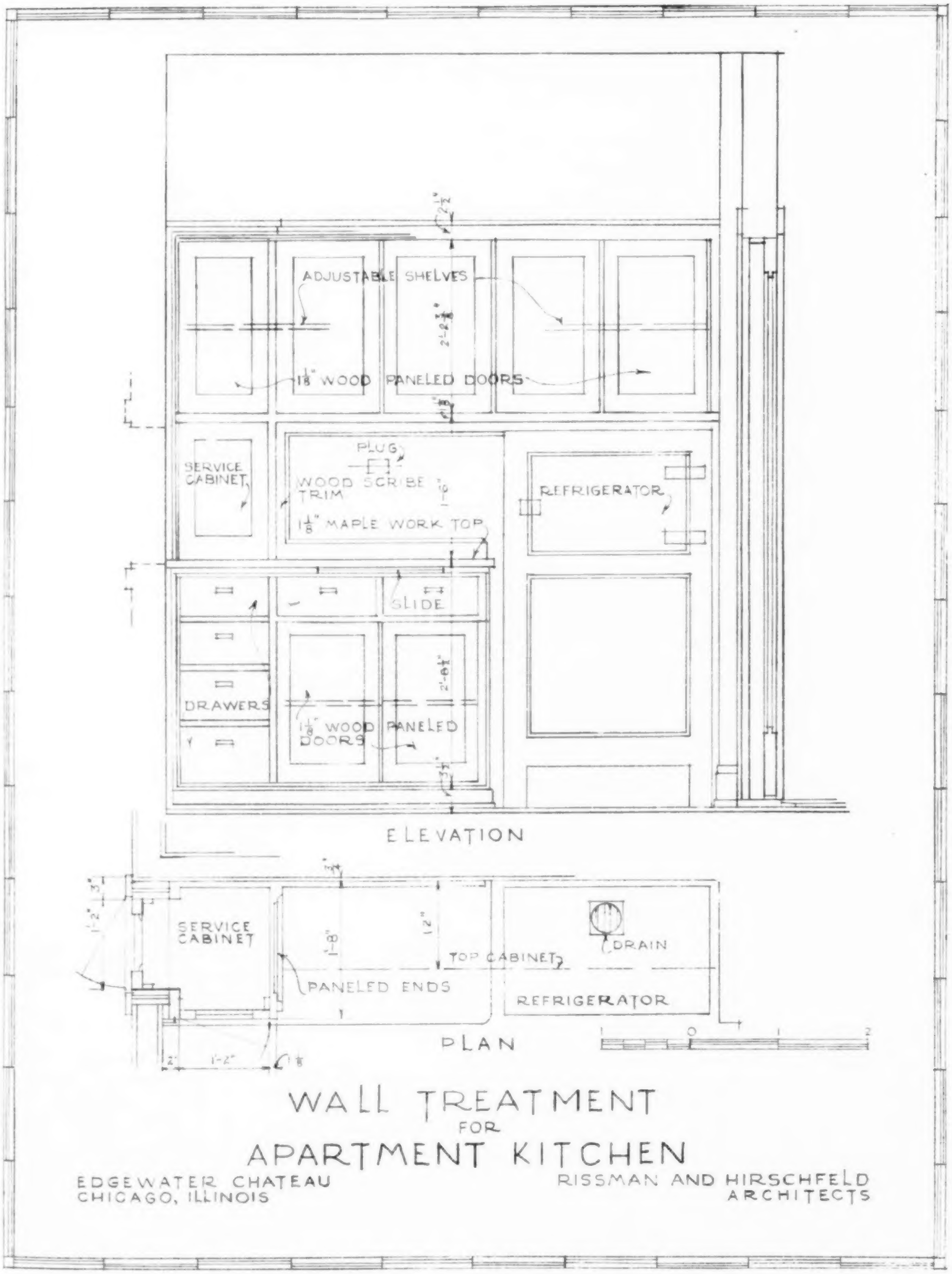
BUILT-IN EQUIPMENT FOR APARTMENT HOUSES

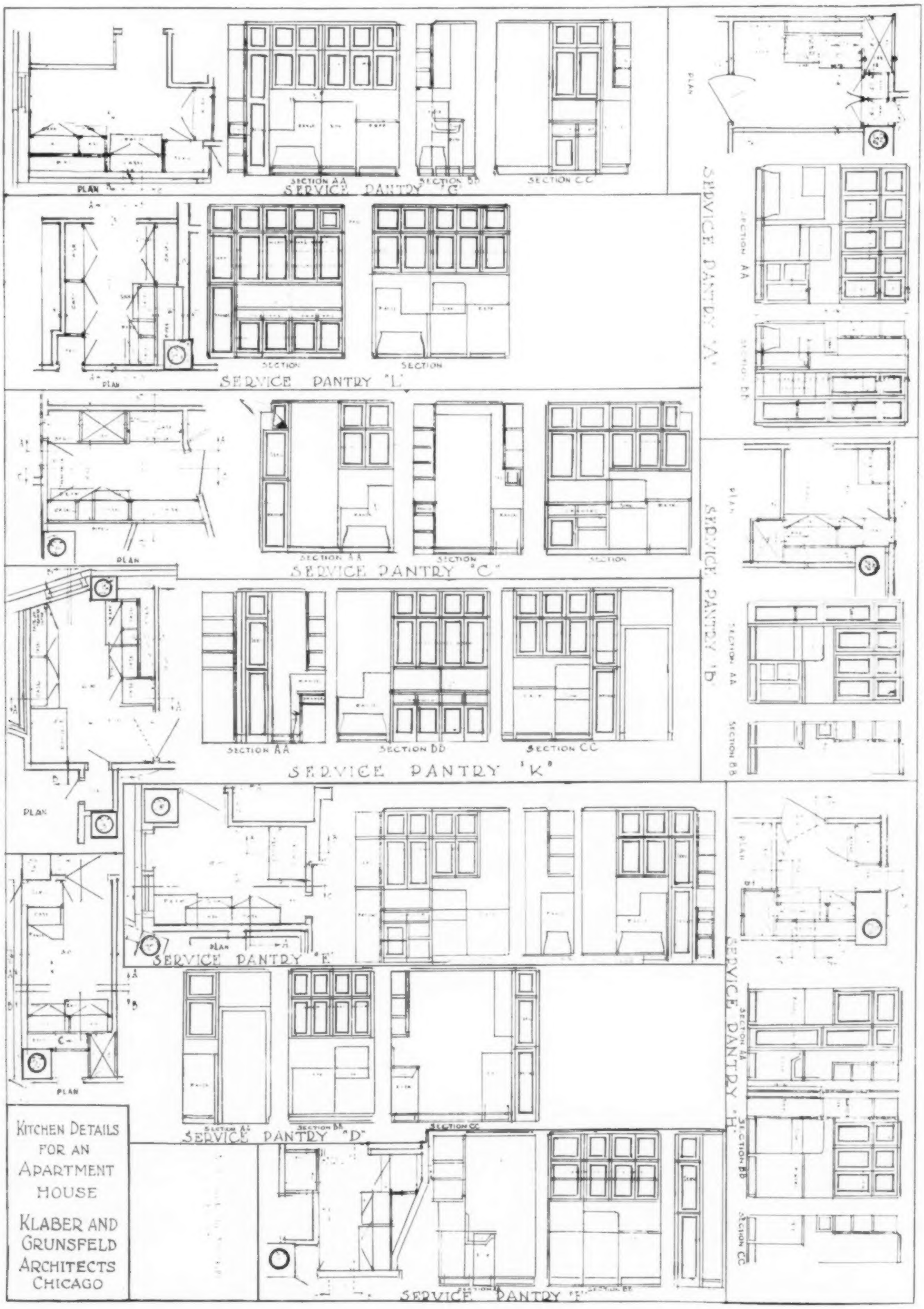




DETAILS OF BUILT-IN DRESSING CABINET

RISSMAN AND HIRSCHFELD, ARCHITECTS


ADJUSTABLE SHELVES
1⅛" WOOD PANELED DOORS
PLUG
SERVICE CABINET
WOOD SCRIBE TRIM
1⅛" MAPLE WORK TOP
REFRIGERATOR
SLIDE
DRAWERS
1⅛" WOOD PANELED DOORS
ELEVATION
SERVICE CABINET
PANELED ENDS
TOP CABINET
DRAIN
REFRIGERATOR
PLAN
WALL TREATMENT
FOR
APARTMENT KITCHEN
EDGEWATER CHATEAU
CHICAGO, ILLINOIS
RISSMAN AND HIRSCHFELD
ARCHITECTS



KITCHEN DETAILS FOR AN APARTMENT HOUSE

KLABER AND GRUNSFELD ARCHITECTS CHICAGO

SUNLIGHT TOWERS

A. LAWRENCE KOCHER AND GERHARD ZIEGLER, ARCHITECTS

ADVANTAGES OF HEIGHT

In the endeavor to find appropriate expression for the apartment house, two fundamental forms have received favor—the low apartment building grouped around courts and the tower type. Where land cost is not excessive, apartment houses may be many storied, not with the purpose of crowding land but to obtain land space for recreation, tennis courts, playgrounds for children, promenades, landscaped areas and distance from streets. The four storied apartment house that holds to the ground closely requires eight times the foundation area of the thirty-two story building with the same room-capacity.

The desirability of height for apartments is reflected in the higher rent demanded for upper floors. Quiet increases with distance from the ground, the outlook from windows is improved, there is better air and more sunshine.

With the low building, on the other hand, there is noise from the streets, monotonous outlook and inevitable shadow resulting from courts and nearness of adjoining buildings.

With new systems of construction and new materials, apartment buildings of tower type may well be increased to forty or fifty stories *when the area saved by the lesser ground coverage is devoted to recreation uses.* Zoning laws could take into account building capacity in relation to setting, requiring a proportionately greater site area as the building height is increased.

SUNLIGHT TOWERS

The accompanying plans are intended to gain this fuller advantage from sunlight by turning rooms to an angle of 45° with the street, giving to the façade a sawtooth face which permits outlook in two directions from every room.

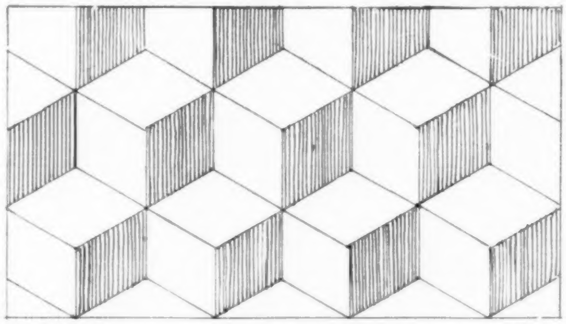
The advantages of the arrangement may be summed up as follows:

Cross ventilation in all rooms.

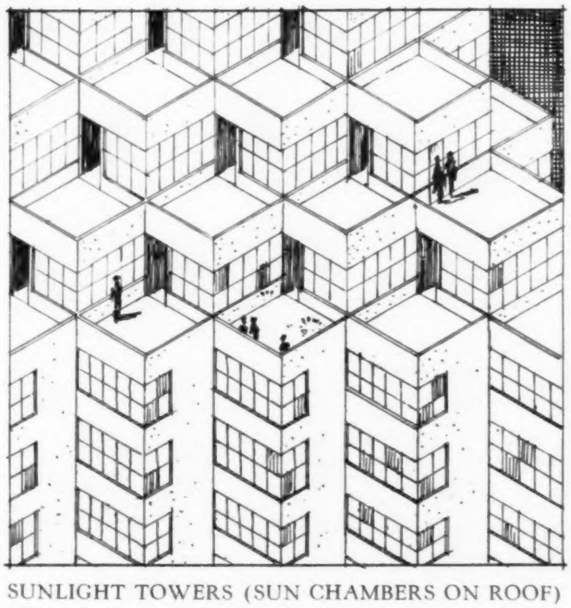
Possibilities for sunshine increased 100 per cent.

(Upper Diagram.) GROUND COVERAGE OF FOUR STORY APARTMENT BUILDINGS WITH INTERIOR COURTS

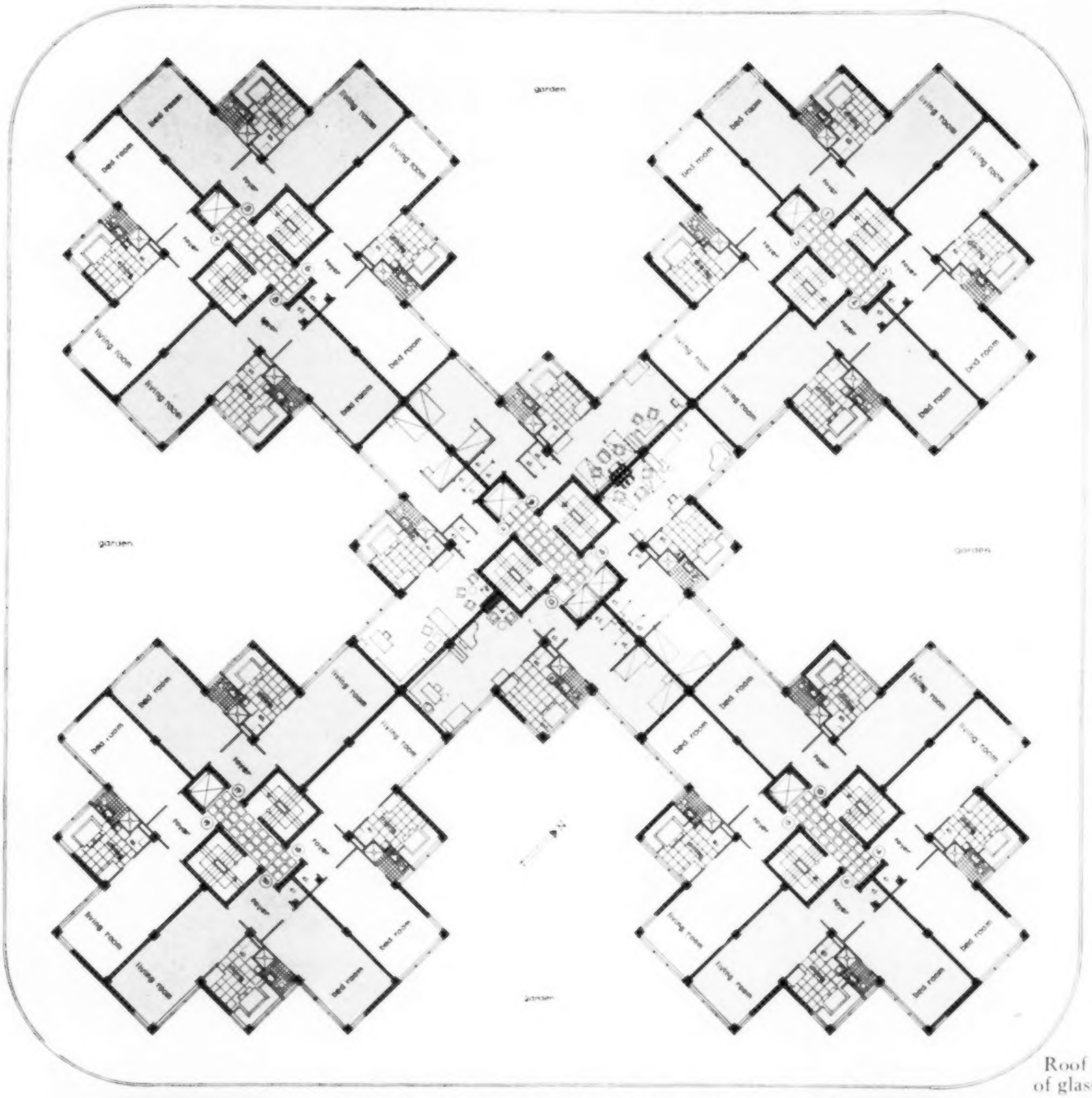
(Lower Diagram.) GROUND COVERAGE OF THIRTY-TWO STORY BUILDINGS OF SAME APARTMENT CAPACITY BUT WITH SURROUNDING OPEN AREAS

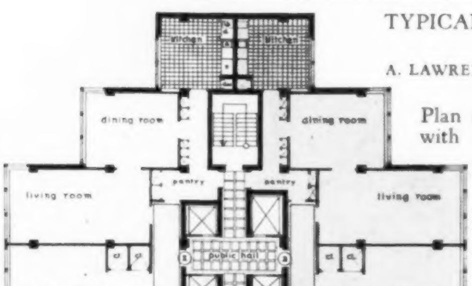


CUBE DIVISIONS CORRESPONDING TO 12'-0" COLUMN SPACING



SUNLIGHT TOWERS (SUN CHAMBERS ON ROOF)





ALTERNATE A.
Six-room
apartments.

TYPICAL FLOOR PLAN OF SUNLIGHT TOWERS

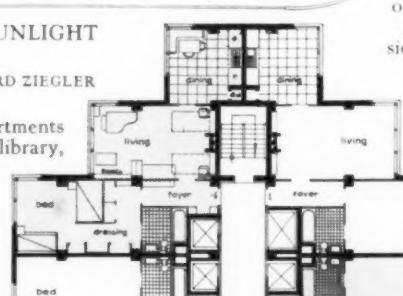
A. LAWRENCE KOCHER AND GERHARD ZIEGLER
ARCHITECTS

Plan above shows 3-room apartments with combined living-room-library, bedroom-dressing room and dining room-kitchen.

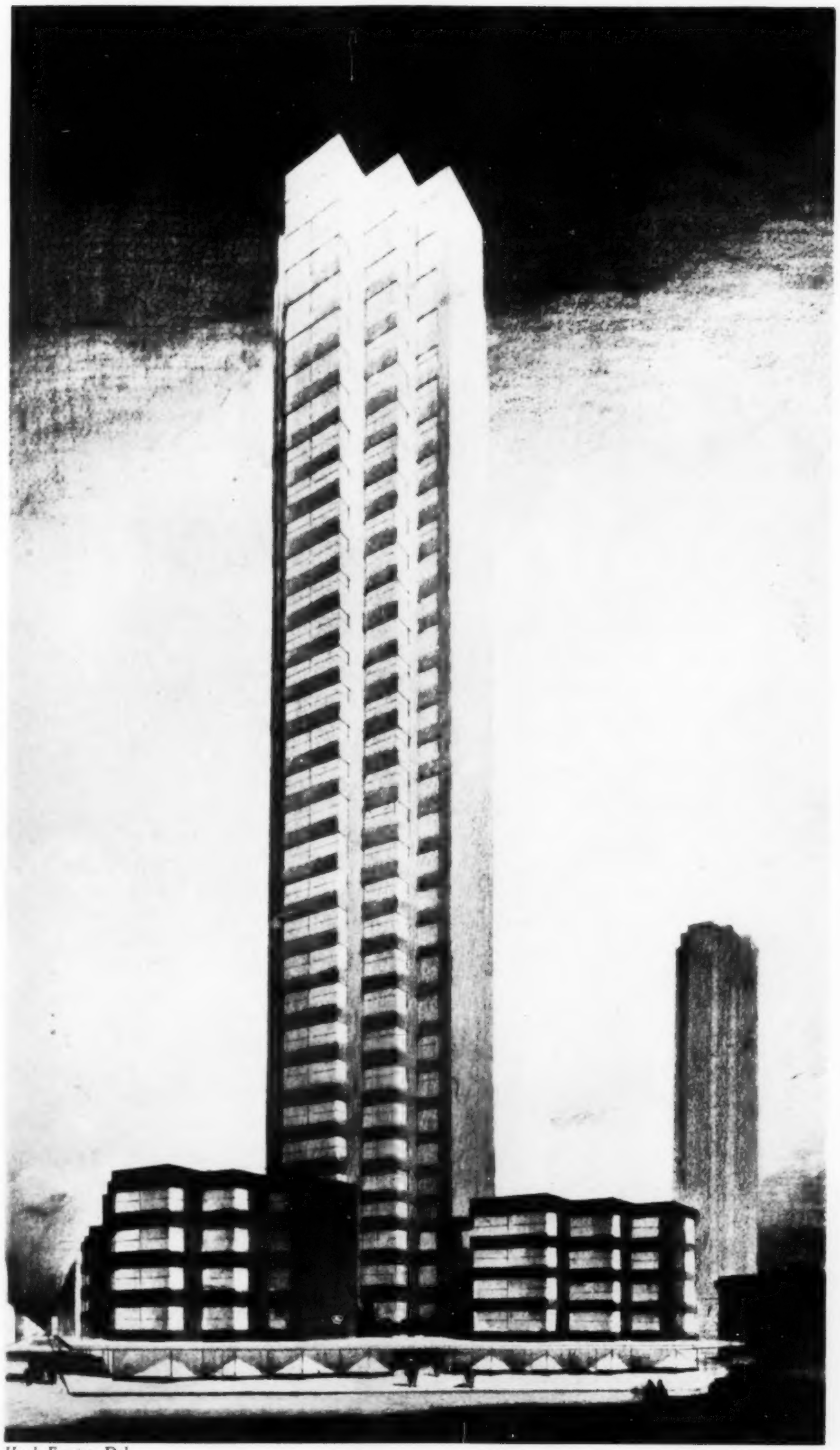
Plan efficiency 88.6%

Ground coverage 60%

Roof
of glass
over
sidewalk



ALTERNATE B.
Three-room
apartments.

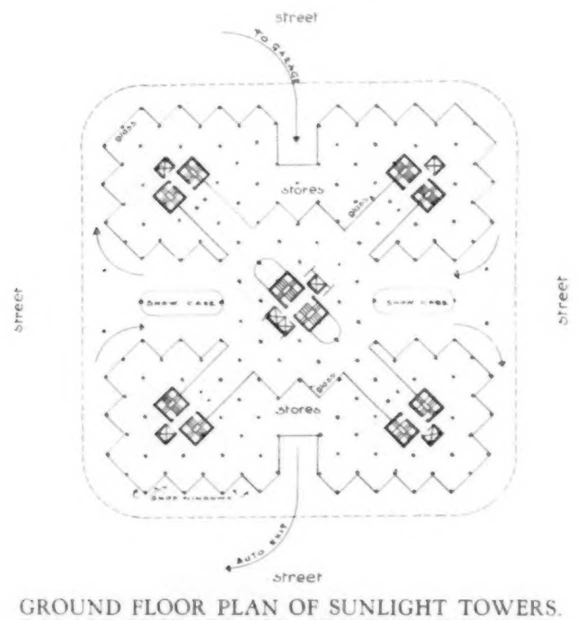


Hugh Ferriss, Del

SUNLIGHT TOWERS

A. LAWRENCE KOCHER AND GERHARD ZIEGLER, ARCHITECTS

ALTERNATE C. Ten-room apartment. Living-dining rooms convertible to ballroom.



GROUND FLOOR PLAN OF SUNLIGHT TOWERS. GARAGE STORAGE FOR APARTMENT IN BASEMENT

60 per cent of the rooms have sunshine three-quarters of the day. Light can be admitted to center of rooms as well as to end, so that deeper rooms are possible.

Windows face in general direction of street rather than toward buildings across street.

Makes possible the use of cantilever construction, permitting a 20 per cent saving of steel. Exterior points of support can be at reëntrant angles, allowing windows to extend around the outer angles.

Girder spacing is identical throughout plan.

Halls are reduced to a minimum.

Equipment concentrated in smallest possible space.

The high building with greater exterior wall surface inevitably costs more than the rectangular, straight-sided building. The advantages for health and improved living should make higher rentals with fewer vacancies counterbalance the increased construction cost.

SHOP WINDOWS

MATERIALS. Exterior walls are of light pre-cast slab construction of aërated concrete. The interior surface of outer walls is lined with insulating material. Steel casement windows with violet-ray glass slide vertically in grooves, thus permitting complete opening and ventilation control.

COLOR. Low buildings are black with glazed surface, contrasting with the tower of light green.

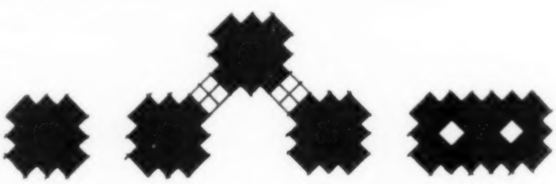
ACCOMMODATIONS. Garage accommodation is provided in basement for occupants of apartments, and is accessible from side streets. Elevators to upper floors serve users of cars from garage level.

Stores are on the first floor and have fully glazed saw-tooth frontage affording a maximum of display space. These may be readily viewed by pedestrians because of the angle, and space for viewing windows is permitted without obstructing sidewalk.

The sidewalk is sheltered by a roof of glass which admits light below and serves as a promenade from the gardens on the second floor level.

The second floor is arranged as a restaurant and coffee shop with a part of the dining space in garden.

Sun rooms, a gymnasium, swimming pool and lounge are at roof levels.



PLAN PATTERNS

BUILDING RENTABILITY INTO APARTMENTS

BY J. O. DAHL

Last Spring, with the building only two years old, a friend of mine was compelled to lower rents by five dollars a room per month because a new house nearby offered apartments with incinerator, ventilated kitchen, sound-retarding floors, radio outlets, silent flush toilets, cedar closets, full-length mirror in bedroom, and soft water—at the same rental. An architect with vision could have convinced my friend that it would have been more profitable to build for tomorrow than for today.

Unquestionably a large percentage of apartment houses have been designed by men with little sympathy for the problems of a woman. Also it appears evident that in most cases such architects are home owners rather than apartment dwellers.

It is obviously unfair to blame solely the architect for the constant shift of population from apartment to apartment. But there is every reason to believe that the architect can render his client a tremendous service by building into the design features that make it unnecessary for the tenant to move each year in order to find a fair degree of happiness.

Such features not only make it easier to rent or sell apartments for the first time but by decreasing the turnover the cost of selling is greatly reduced. Obsolescence is retarded by building for the future rather than for the present and the reduction in turnover in rentals certainly saves on wear and tear, re-decorating apartments, credit losses, bookkeeping, advertising and general administration. In an increasingly large number of cases, building salable features into apartments makes it possible to sell two- and three-year leases, with obvious economy for the owner and the tenant.

Next to hotel patrons, apartment dwellers are becoming most discriminating in their demands for luxury and the elimination of petty annoyances. The complexities and high pressure of business life make it important to find in a home the relaxation which is synonymous with freedom from noise, dirt, interruptions, unpleasant odors, drafts, slamming doors, fear of fire, spoiled food, disturbing color schemes and many other factors that architects may overcome by the use of features listed on the accompanying table.

No one apartment house needs all the features listed, but certain of them are absolutely essential today. The elimination of others that might seem less necessary may mean greatly reduced rentals when, in a year or two, the building has to compete with houses containing features which cannot be put into an older house without the expenditure of an amount that might make the cost prohibitive.

Close coöperation between the owner and architect regarding this important subject is certain to react to the advantage of all concerned. The architect who, while he is designing for beauty and economy of construction, keeps in mind rentability and salability is certain to find his services in great demand.

112 Construction Features that Increase the Salability of Apartments

Key E=excellent feature G=fairly good feature O=of little value	For Moderate Priced Apartments	For High Priced Apartments
Central cleaning (vacuum)	O	E-2
Soundproof construction	E-3	E-3
Ultra-violet-ray glass	G-4	E-4
Friction door hinges	G	E
Carpeted corridors	G-1	E
Locks above knobs (safety)	E	E
Fireproof construction	E	E
Mechanical ventilation	E-1	E-5
Automatic refrigeration (silent)	E	E
Tub and shower combination	E	E
Glass enclosed showers	G-1	E
Wide corridors	O	E
Extensive, decorative lobby	G-1	E
Ventilator doors	G	E
Servidor	G	E
Garage in building	E	E
Self-leveling elevators	G-1	E
Automatic door checks	G-1	E
Phone connection in each room	O	E
Radio connection in each room	E-6	E-6
Wood burning fireplace	E-1	E
Weather strips	E	E
Broom closet	E	E
Dumb-waiter	E-7	E-7
Numerous electric outlets	E	E
Luminous door numbers	E	E
Temperature control	G-1	E
Radiator enclosures	O	E-8
Colored awnings	E	E
Rolled screens	G-1	E
Incinerator	E	E
Clubrooms	G-1	O
Playroom	E-1	E
Laundry equipment in basement	E	E
Provision for pets	G-1	E
Roof garden	E-1	E
Solarium	E-1	E
Outside parking space	E	E
Rooms for servants	O	E

Key
E = excellent feature
G = fairly good feature
O = of little value

	For Moderate Priced Apartments	For High Priced Apartments
Steel storage lockers	E	E
Silent flush toilets	E	E
Automatic shower mixer	E	E
Cedar closets	E	E
Circulating ice water	E-1	E
Full length mirrors	E	E
In-A-Door beds	E	E
Wall safe	O	E
Food shop	E-9	E-9
Casement windows	E	E
Modern wall finishes	E	E-10
Linen closet	E	E
Ample hangers in closets	E	E
Shoe racks " "	E	E
Hat stands " "	E	E
Mixing faucets	E	E
Room clocks (electric)	O	E
Landscaped exterior	E	E
Ample basement storage	E	E
Special trunkroom	G	E
Laundry tub in kitchen	E	G
Modern clothes drier in laundry	E	E
Safety features on elevators	E	E
Built in bookcases	E	E
" " drawer space	E	E
" " ironing board	E	E
" " dinette	E	E-12
" " kitchen cabinet	E	E
" " dish storage	E	E
Large window space	E	E
Cross ventilation	E	E
Large drains in bath, etc	E	E
Immediate hot water	E	E
Heated bathroom (all year)	E-1	E
Colorful kitchen	E	E
Ample table space in kitchen	E	E
Well lighted corridors	E	E
Ample light in kitchen	E	E
Steel medicine cabinet	E	E
Light for shaving	E	E
Bathroom outlet for electric iron	E	E
Drawer space in bathroom	E	E
Bathroom in tile (color)	E	E
Colored shower curtain	E-1	E
Modern facilities for hanging pictures	E	E
Storage for baby carriages (first floor)	E	E
Decorative lighting fixtures	E	E
Large rooms	E-1	E
Unbroken wall areas	E	E
Quality window shades	E	E
Flower boxes	E-1	E
Gas or oil burners (noiseless)	G	E
Special flooring—cork, rubber, linoleum, etc	E-1	E
Group outlets for kitchen utensils	E	E
Built-in laundry hamper	G	E
Quality of range and oven	E	E
Ample closet space	E	E
Built-in can and bottle openers	E	E
Pencil sharpener, towel racks	E	E
Soap dishes, toilet tissue holder	E	E
Hot water bag hook, clothes hooks in bathroom	E	E
Bathroom, curtain hooks	E	E
Ballroom	O	E-1
Covered carriage entrance	G-1	E
Soft water for laundry	E-1	E
Rustless hot water lines	E	E
Ease of entrance	E-13	E-13
Decorative mailboxes	E-14	E-14
Chair over toilet seat	O	E
Decorative Entrance	E	E-11

Comments

1. When it is practical from the standpoint of initial cost and upkeep.
2. When corridors are carpeted and when apartments are cleaned by building operators. Carpets are usually cleaned by central cleaning system weekly or semi-weekly. Hand electric cleaners are used for daily cleaning.
3. Becoming more essential due to widespread use of radio, musical instruments, dancing at home, electric exercisers, etc.
4. Of special value for children, invalids and older people.
5. Especially in kitchen and bathroom or laundry when washing odors are apt to permeate corridors.
6. An absolute necessity within a few years.
7. For deliveries where it is impossible to have them made through a special door direct from corridor into kitchen.
9. With chain store prices. A handy chain store is a decided factor in renting. This is true especially in small cities and suburban communities.
10. But it is often unwise to finish walls until tenant can decide what he or she wants. This is true especially in the case of radical colors or new finishes.
12. In small apartments only.
13. Extra steps, heavy doors and tight door-checks are especially undesirable to women and children.
14. Women especially are enthusiastic about small features that give a house an artistic appearance.

SHOULD WE REGULATE THE FORM AND PLAN OF APARTMENT BUILDINGS?

BY ARTHUR C. HOLDEN

NEW YORK'S DWELLINGS BILL is designed to replace the Tenement House Law enacted in 1901. It is a valuable codification of the progress that has been made in apartment construction in the last twenty-eight years, yet, strange to say, it contains provisions which will add to the canyon-like aspect of New York's congested streets. There are provisions in the bill which the city dweller and the architect who ministers to his comfort cannot but view with alarm. For example, fireproof buildings which front sixty-foot streets are now allowed to be carried ninety feet high and then a twelve-foot pent house is permitted on the roof. The new bill allows two intermediate set-back stories to be added between the ninety-foot cornice and the pent house, making a total allowed height of one hundred and twenty feet. On streets one hundred feet wide, apartments may now be carried one hundred and fifty feet high and then a twelve-foot pent house may be built on the roof. Three additional stories are to be allowed between the main cornice and the pent house, increasing the total height to one hundred and ninety feet.

As one reads over the sizes prescribed for courts and yards and compares them with the sizes set down in the 1901 Tenement House Law, the first impression is one of astonishment at the general increases. But as one works out the exceptions and the decreases allowed for this or that reason, one realizes the inadequacy of the inches that are gained for light and air in courts and yards in exchange for the greater height and bulk allowed for fireproof buildings and the greater bulk also allowed for non-fireproof construction.

There has been so much talk about compromise and the impossibility of realizing the high standards asked by those architects who claim to speak with the public interest in view, that it is well to inquire briefly into some of the underlying principles involved. Why, indeed, should there be any legal restriction at all?

Any law which regulates the form and plan of buildings is bound to be irritating to architects. Nevertheless, wherever land values are expensive enough to make it difficult for land to earn its carrying charges without overcrowding, it has seemed necessary to prohibit the abuse of land. Otherwise economic competition from sub-standard developments would make desirable standards impossible to maintain.

Municipalities apparently have too immediate an interest in the taxable value of land to deal disinterestedly with this problem. For this reason state housing codes are necessary which set minimum standards of light, air, and sanitation.

Regulation must, of course, apply equally to all. Thus the restriction must be based not upon the conditions produced when one piece of land is intensively developed, but upon the conditions that would be produced if the adjoining and neighboring properties were developed equally intensively. We have been loath to recognize this principle and to some extent we have been deceiving ourselves as to the effectiveness of the standards set up by law. Building by its nature is a gradual process. The average building which is developed to the limits of permitted intensity depends upon and benefits from the light that it borrows from adjoining properties which are not as yet developed to the same limit.

The Dwellings Bill falls into the same error as its predecessor by failing to protect adjoining properties from the blanketing effect of high walls and indeed from failing to protect the streets themselves which are the principal source of light. Perhaps it is a gain that those responsible for drafting the bill have introduced the principle of a lot line set back at a height equal to one and one-half times the width of the street. To be really effective it should have been introduced at a lower level. It is to be deplored, too, that the Commission has not yet seen fit to reduce the cornice line, for the additional stories of height that have been granted are a real menace without this protective measure.

The Commission apparently lacked the courage to overcome its fear of the economic bugaboo. There has been much talk about the rising value of land. Values are not all top values. They range from several hundred dollars a square foot down to several dollars a square foot. A given proposition may become uneconomic because the value of the land calls for a more intensive development than permitted, but there is plenty of land available at a lower figure on which the development may be carried out and reasonable standards maintained. Undesirable standards are not a necessity. They are the result of abuse. High standards of light and air for residential properties are a public necessity, therefore architects should be ever alert to keep public opinion informed, for without the support of public opinion no decent standards can be maintained.

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BOOK REVIEWS

PLAY AREAS

Play Areas—Their Design and Equipment. Prepared by the Playground and Recreation Association of America, New York City. A. S. Barnes & Co., publishers. $2.50.

PLANNING for recreation as it relates to children's playgrounds, playfields, and athletic fields, is set forth in a challenging, attractive and highly practical way in this new book issued by the recognized national agency in this field—The Playground and Recreation Association of America. The best experience of over a quarter of a century's work by municipalities and private agencies in making provision for play has been gathered together, classified, evaluated and presented here in usable form. The book is a complete and dependable guide for the physical development of play areas.

American municipalities are spending approximately thirty-five million dollars annually for public recreation. A substantial part of this is being used for the acquisition and development of new areas and the application of improved methods in design, planting and equipment. This handbook of up-to-date technique comes from the press at an opportune moment. Time was when the first step in laying out a playground was to denude it of all vegetation and reduce it to a monotonously level, sun-scorched prairie. The central space was then cluttered up with an ungainly and expensive lot of outdoor gymnasium apparatus. A caretaker, instead of a play leader, was placed in charge. Then the community sat back in satisfied complacency considering that it had handsomely discharged its playground responsibility to its children. After the novelty of this new plaything had worn off and the children began to drift back to the shady alleys, the streets and tree-covered vacant lots, the good people were mystified and considerably discouraged. Their enthusiasm for playgrounds was further dampened by discovering that these unattractive, little-used play centers tended to lower nearby real estate values.

Out of this experience, the new playground technique has developed. The Playground and Recreation Association of America, with its staff of field workers and its regional institutes and national congresses, took the lead in grappling with these problems of public recreation. It was soon discovered that accessibility, beauty, comfort, design and capable play leadership were indispensable factors.

It is pointed out that the community should not only have ample space for play, but should see that proper consideration is given to the environment of the spaces in which play is carried on. Thus the playground becomes as important as the school building, and the environment of the playground becomes even more important than the mechanical apparatus with which it is equipped.

In laying out the playground, consideration should be given not only to how it ministers to the needs of the child in developing his physique, but to what effect it has upon his mind and character. The playground that is well designed and attractively planted will act as a mental stimulus and will help to refine and develop character. On the other hand, a playground that is nothing more than a vacant piece of land without planting, or has untidy surroundings, or has noisy traffic streets adjacent to it, although it may be a better alternative than the street itself, will not serve the children of the community to the best advantage in stimulating right ideals and reactions, however perfect its facilities for muscular development may be.

Planning for play has found its place as a recognized aspect of city planning. *Play Areas* is an up-to-date guide book on this subject. Its one hundred and thirteen photographs, plans and construction drawings help the reader to visualize the principles of planning and developing which are set forth in the text. Grading, surfacing, draining, fencing, lighting, location of apparatus and construction of wading pools, swimming pools and playground buildings are some of the subjects about which detailed instructions are given. The appendix contains a well selected and classified bibliography.

LEE F. HANMER

ACOUSTICS

FLETCHER, HARVEY.

Speech and Hearing. 319 p., illus. D. Van Nostrand Company, 1929. $5.50.

THE understanding of the phenomena of sound and hearing is essential to any attempt to control architectural acoustics or sound insulation.

For fifteen years the Research Laboratories of the Bell Telephone System have undertaken a comprehensive study of speech and hearing. The book by Harvey Fletcher represents the findings of this prolonged investigation. It deals with the physics of sound, hearing, speech, music and noise. Audible sound, ranging from the quiet of the country house to the roar of a boiler factory are classified in the survey of noise.

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NOTES IN BRIEF

CALENDAR OF EVENTS

I. General Announcements

March 2-18	Exhibition of watercolors and drawings of André Leconte at the Massachusetts Institute of Technology, Boston.
Feb. 11-March 24	American Industrial Arts. 11th Exhibition. Metropolitan Museum, New York City.
March 1-31	Exhibition of work of Reginald Johnson. Architect's Building Material Exhibit, Los Angeles.
March 18-April 3	Exhibition of watercolors and drawings of André Leconte at Yale University, New Haven, Conn.
April 3-18	Leconte Exhibition at Michigan University, Ann Arbor.
April 15-27	Architectural and Allied Arts Exposition (Arch. League of N. Y.). Grand Central Palace, New York.
April 17-May 11	"Own Your Home" Exposition, indoor and outdoor, Chicago.
April 23-25	Producer's Council. Annual Meeting in conjunction with
April 23-25	American Inst. of Architects' Annual Meeting, Washington, D. C.
May 30	National Commemoration of Major Pierre L'Enfant and William Thornton, by Federal and state organizations devoted to architecture.
June 13-15	International Hospital Congress at Atlantic City. Exhibition of plans and models of modern American hospitals.
June 19-23	International Management Institute. Paris.
Sept. 12-19	International Housing and Town Planning Congress. Rome.
Oct. 29-Nov. 7	World Engineering Congress. Tokio, Japan.

II. Competitions

April 1	Columbus Memorial Lighthouse Competition drawings must be in Madrid, Spain.
April 1	A. W. Brown Travelling Scholarship Competition. Drawings to be delivered. Programmes mailed March 1st. Wm. Dewey Foster, 25 West 45th Street, New York City.
April 6	George G. Booth Travelling Fellowship in Architecture. Annual Competition held for two weeks. Professor Emil Lorch, University of Michigan, Ann Arbor.

A SELECTED LIST OF BOOKS ON ARCHITECTURE OF THE MODERN MOVEMENT

GENERAL

Bauhausbücher. Edited by Gropius and Moholy-Nagy. Monographs on the modernist movement.
Kandinsky. $4.50.
Klee. *Paedagogisches Skizzenbuch.* $2.50.
Doesburg. *Grundbegriffe d. neuen gest. Kunst.* $2.25.
Meyer. *Versuchsbuch d. Bauhauses in Weimar.* $2.25.
Oud. *Holländische Architektur.* $2.00.
Mondrian. *Neue Gestaltung.* $1.50.

L'Esprit Nouveau. All profusely illustrated. Each $3.00.
Le Corbusier. *L'Urbanisme.*
Le Corbusier. *L'Art Decoratif D'Aujourd'hui.*
Le Corbusier. *Vers Une Architecture.* [Translation by F. Etchells, *Towards a New Architecture* (1927—$6.00).]
Almanach D'Architecture Moderne.

Frankl, Paul T.
New Dimensions. The decorative arts of today in words and pictures. (1928—$6.00.) Payson & Clarke, N. Y.

Le Corbusier
Une Maison—Un Palais. A la Recherche d'une Unité Architecturale. (1928—$3.00.)

MATERIALS

Bennett
Architectural Design in Concrete. 100 Plates. (1927.) $10.00. Oxford Univ. Press.

Ciment-Roi, Le
Realizations architecturales recentes. Ossatures, formes, ornaments. 60 Plates. Librarie de la Construction Moderne. $10.00.

Janneau, G.
Le fer a l'Exposition Internationale des Arts Decoratifs Moderne. (1924-1925. Out of print.)

Onderdonk, Francis S., Jr.
The Ferro-Concrete Style. With 400 illus. of European and American Ferro-Concrete Design. (1928.) $12.00. Arch. Book Pub. Co.

DESIGN

American

Neutra, Richard
Wie Baut Amerika? A European, now a practising architect in the United States, writes about American architecture of the present day, emphasizing particularly structure and materials. (1927.) $2.50. Weyhe.

Park, E. A.
New Backgrounds for a New Age. 93 illus. of modern decorative art and architecture. (1927.) $5.00. Harcourt, Brace & Co., N. Y.

Wright, Frank Lloyd
The Life-Work of. By H. Th. Wijdeveld and others. Many illustrations. (1925.) $17.50. Weyhe.

Wright, Frank Lloyd
Aus dem Lebenswerke eines Architekten. By H. de Fries. Over 100 illus. (1926.) $4.00. Weyhe.

Wright, Frank Lloyd
A monograph. By Henry-Russell Hitchcock, Jr. In French. (Paris, 1928.) $2.00. Weyhe.

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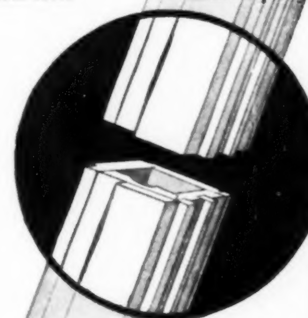

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Andersen Box Frames installed by John H. Kelley & Sons, Builders.

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French

Badovici

Harmonies, Interieurs de Ruhlmann. The work of a well-known modern French decorator. (1924.) $12.00.

Cafés, Bars et Restaurants, 40 Plates of Photographic illustrations. Librarie de la Construction Moderne. $5.00.

Encyclopédie de L'Architécture

Constructions Modernes, Vol. I. With 100 Plates, portfolio. (1928.) $9.00.

Herbst, René

Devantures, vitrines, installations de magazins a l'Exposition Internationale des Arts Decoratifs, Paris, 1925. 55 Plates. $9.00.

Herbst, René

Nouvelles Devantures et Agencements de Magazins Parisiens. 54 Plates. (1927.) $10.00.

Quenioux, G.

Les arts decoratifs modernes. More than 800 illus., including interiors, furniture, ironwork, textiles, etc. (1925.) $7.50.

Robertson and Yerbury

Examples of modern French architecture. (1928.) $10.00. Scribner's.

Roux-Spitz, M.

Bâtiments et Jardins. Exposition des Arts Decoratifs, Paris, 1925. With 100 Plates. (1927.) $15.00.

Samy

Le Home Moderne. 20 Plates in color illustrating designs for modern French domestic interiors. $7.50.

Sézille

Devanture de Boutiques. Modern Parisian shop fronts. 48 Plates, 80 illus. (1927.) $12.00.

Société des Artistes Decorateurs

Une ambassade française. Reproductions for living rooms for a French embassy building done in the modern manner, exhibited at the Paris Exposition of Decorative Arts, 1925. Interesting architectural features designed by eminent architects. (1925.) $12.50.

Virette, Jean

Interieurs Modernes et Rustiques. With 56 illus. (1928.) $9.00.

German

Grosskraftwerk Klingenburg. Modern Factory. With over 100 illus. (1928.) $4.00. Weyhe.

Koch

Farbige Wohnraüme der Neuzeit. Colored interiors. With 140 Plates, many in colors. (1927.) $20.00.

Moderne Ladenbauten. (Modern Shops) Exteriors and interiors. With illus. (1928.) $12.00.

Platz, Gustav Adolf

Die Baukunst der neuesten Zeit. The most comprehensive survey of modern German and Dutch architecture. 500 illus. (1927.) $14.00. Weyhe.

Neue Werkunst. Series. Brief introduction and numerous plates. The work of well-known German architects. (1928.) Each $4.00.

Salvisburg, O. R.
Joseph Hoffmann
Max Taut
Wilhelm Kreis
Heinrich Straumer
Bauten der Gemeinde Wien am Fuchsenfeld
Wilhelm Ripholm
Friedrich Wagner-Pottrock
W. Eckenrath
W. Schurig

Taut, Bruno

Ein Wohn Haus. Illus. (1927.) $2.50. Weyhe.

Witzman, Professor Carl

Das Theater in der Josefstadt in Wien. (1927.) $3.00. Weyhe.

Scandinavian, Danish and Dutch

Ahlberg

Modern Swedish Architecture. The work of 23 architects. 123 Plates. (1926.) $25.00.

Fisker and Yerbury

Modern Danish Architecture. Introduction deals with history of modern architecture in Denmark. 100 Plates. (1927.) $10.00. Scribner's.

Mieras and Yerbury

Modern Dutch architecture of the 20th Century. 100 Plates of photographic illus. (1926.) $10.00. Scribner's.

Wattjes, J. G.

Nieuw-Nederlandsche Bouwkunst. 2 vols. 328 illus. (1926.) $12.00.

Moderne Architectuur in Norway, Sweden, Denmark, Germany. With over 300 illus. of modern European architecture. (1927.) $9.00.

Wettergren, E

Modern decorative arts of Sweden. Illus. (1926.) $7.50.

PUBLISHERS AND BOOKSELLERS

E. Weyhe, 794 Lexington Avenue, New York.
William Helburn, Inc., 15 E. 55th Street, New York.
Architectural Book Publishing Company, 108 West 46th Street, New York.
Brentano's, 1 West 47th Street, New York.
Charles Scribner's Sons, 597 Fifth Avenue, New York.
J. H. Jansen, Caxton Building, Cleveland, Ohio.
John Tiranti & Company, London.
B. T. Batsford, Ltd., London.

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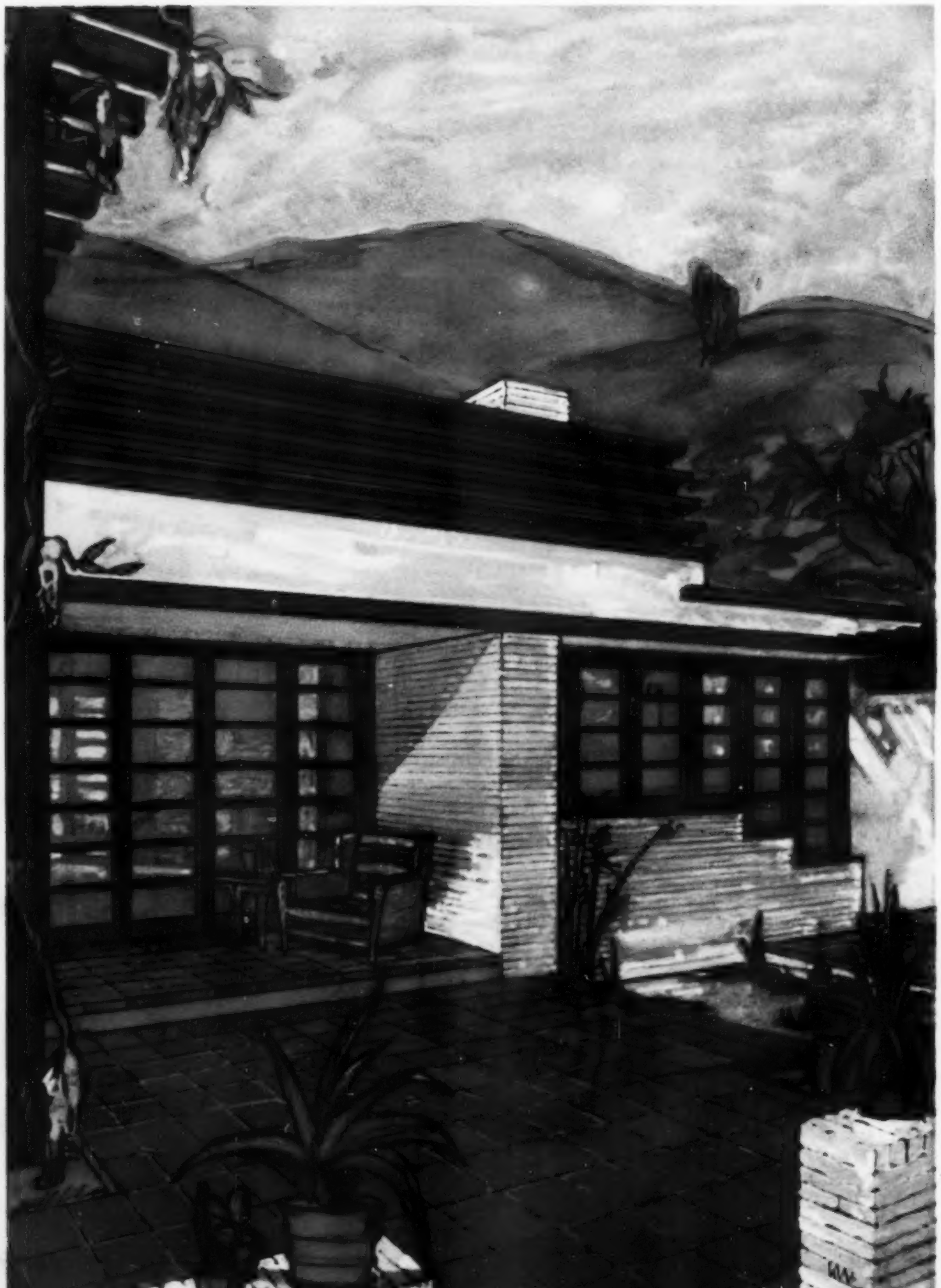

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